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**Business Process Reengineering on High Education Institutions –  
An Integrative Approach of Enterprise Architecture and Service  
Design Methods**

*Sérgio Pedro de Matos Duarte*

**Master Dissertation**

Supervisor at FEUP: Prof. António Carvalho Brito

Supervisor at ISCAP: MEng. Rui Pereira



Universidade do Porto

Faculdade de Engenharia

**FEUP**

**Faculdade de Engenharia da Universidade do Porto**

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*I would ask the obvious question, 'what are you smiling about?' But I already know the  
answer: 'It just gets better from here.'.*

*Michael J. Fox*



## **Abstract**

Business Process Reengineering and Information Systems implementation are two common approaches in Higher Education Institutions to solve management issues related to students. Lack of human resource, increasing number of students and technology evolution were the most important drivers for rethinking management and improving efficiency. Time spent with daily tasks involving students' information was causing students to be unsatisfied with the service and employees had to work over time during critical periods of the year.

Redesigning processes and use Information Technology to support those processes became necessary to improve the quality of supporting activities in Higher Education Institutions. However, these approaches focus only on the staff activities and impose activities to students. To overcome that flaw, it is possible to use a Service Design approach, by considering the student as the customer of a service. The adoption of the concept of Student Relationship Management in some schools already shows the idea of treating students as customers. On the other hand, it is not so common to include Service Design methods in a project of Business Process Reengineering.

This research is based on a real case in a Portuguese Higher Education Institution and proposes a methodology that integrates methods from Enterprise Architecture and Services Design. So, it joins aspects from Business Process Reengineering with Enterprise Architecture Design and Multilevel Service Design in order to achieve a better satisfaction of internal and external perspectives of a service. By doing so, it considers the hypothesis of integrating Multilevel Service Design method in the Zachman Framework for Enterprise Architecture.

**Keywords:** Business Process Reengineering, Service Design, Enterprise Architecture, Zachman Framework, Student Relationship Management



## **Reengenharia de Processos de Negócio em Instituições de Ensino Superior – Uma Abordagem Integradora de Métodos de Arquitetura de Empresa e Desenho de Serviços**

### **Resumo**

A Reengenharia de Processos de Negócio e a implementação de Sistemas de Informação são duas das abordagens mais comuns face à problemática da gestão académica em Instituições do Ensino Superior. A falta de recursos humanos, o aumento do número de alunos e as novas tecnologias são as principais razões para levar a cabo projetos de melhoria de gestão e aumento de eficiência. O tempo dispendido com atividades ligadas à gestão de informação dos alunos causava insatisfação da parte dos alunos e os funcionários eram obrigados a trabalhar horas extra em períodos mais críticos do ano.

O redesenho de processos e a utilização de Tecnologia de Informação para suportar tais processos tornou-se essencial para melhorar a qualidade dos serviços académicos nas Instituições do Ensino Superior. Contudo, estas abordagens focam apenas aspetos internos debruçando-se sobre as atividades dos funcionários e impondo algumas tarefas aos alunos. A utilização de uma abordagem com base no Desenho de Serviços possibilita ultrapassar essa falha ao considerar o aluno como um cliente. O conceito de *Student Relationship Management* já é utilizado nalgumas escolas transmitindo esta ideia do aluno como cliente. Por outro lado, não é muito comum incluir metodologias de Desenho de Serviços num projeto Reengenharia de Processos de Negócio.

Este estudo é baseado num caso real de uma Instituição de Ensino Superior Portuguesa e sugere uma metodologia que integra métodos de Arquitetura de Empresas e Desenho de Serviços. Por isso, junta aspetos da Reengenharia de Processos de Negócio com o método de Desenho de Arquitetura de Empresas e o Desenho Multinível de Serviços de forma a alcançar uma maior satisfação de perspetivas internas e externas ao serviço. Ao fazer isso, considera a hipótese da integração do método de Desenho Multinível de Serviços na *framework* de Zackman para Arquitetura de Empresas.

**Palavras-chave:** Reengenharia de Processos de Negócio, Desenho de Serviços, Arquitetura de Empresas, Framework de Zachman, Student Relationship Management.





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## **Symbols and Abbreviations**

ADM – Architecture Develop Method

BI – Business Intelligence

BP – Business Process

BPM – Business Process Management

BPMN – Business Process Model Notation

BPR – Business Process Reengineering

CRM – Customer Relationship Management

CTI – Computer Telephony Integration

CVC – Customer Value Constellation

EA – Enterprise Architecture

ECTS – European Credit Transfer System

ERP – Enterprise Resources Planning

ESE – Escola Superior de Educação –Education School

ESEIG – Escola Superior de Estudos Industriais e de Gestão – Management and Industrial Studies School

ESMAE – Escola Superior de Música e Artes do Espectáculo –Music and Performing Arts School

ESTGF – Escola Superior de Tecnologia e Gestão de Felgueiras – Felgueiras’ Management and Technology School

ESTSP – Escola Superior de Tecnologias da Saúde do Porto – Porto’s Health Technologies School

FEA – Federal Enterprise Architecture

FEAF – Federal Enterprise Architecture Framework

GAIE – Gabinete de Apoio à Inovação em Educação – Innovation for Education Support Office

GAMC – Gabinete de Avaliação e Melhoria Contínua – Continuous Improvement and Evaluation Office

GIAF – Sistema de Gestão Integrada Administrativa e Financeira – Administrative and Financial Integrated Management System

GOA – Goal Oriented Analysis

HE – Higher Education

HEI – Higher Education Institution or Higher Education Institutions

HR – Human Resources

IPP – Instituto Politécnico do Porto – Porto’s Polytechnic Institute

IS – Information System

ISA – Information System Architecture

ISCAP – Instituto de Contabilidade e Administração do Porto – Porto's Accounting and Administration Institute

ISEP – Instituto Superior de Engenharia do Porto – Porto's Engineering Institute

IT – Information Technology

MRP – Materials Requirements Planning

MSD – Multilevel Service Design

PAOL – Projecto de Apoio Online – Online Support Project

SAR – Scientific Area Responsible

SD – Services Design

SEB – Service Experience Blueprint

SGA – Sistema de Gestão de Alunos – Students Management System

SGCA – Sistema de Gestão de Controlo de Acessos – Accesses Control Management System

SGCP – Sistema de Gestão de Controlo de Presenças – Attendance Control Management System

SGH – Sistema de Gestão de Horários – Schedule/timetable Management System

SGRH – Sistema de Gestão de Recursos Humanos – Human Resources Management System

SGV – Sistema de Gestão de Vigilâncias – Surveillances Management System

SIIC – Sistema Integrado de Impressão e Cópia – Copy and Print Integrated System

SMS – Short Message Service

SO – Secretaria Online – Online Secretary

SRM – Student Relationship Management

SSA – Service System Architecture

SSN – Service System Navigation

TOGAF – The Open Group Architecture Framework

## 1 Introduction

In the end of the 1990's decade, Portuguese Higher Education Institutions (HEI) started facing the problem of managing information associated with students. The increasing number of students was causing a delay on the activities performed by management services, leading to a low service level and to general dissatisfaction.

Before this situation, most institutions began programs of computerizing their activities. With time it was understandable that those programs needed to go further and include concepts used in other industries and already under research in other countries. Concepts such as Customer Relationship Management (CRM) were adapted to education, and Enterprise Resource Planning (ERP) software was used to manage information about courses, facilities, employees' data and other resources from services industry, namely, HEI.

Some schools chose to approach the problem with a Business Process Management perspective (BPM), innovating how tasks were performed based on emerging technology systems at the time. Other schools only transferred the existing processes to Information Systems (IS).

With recent technology development, services gained more visibility due to the possibility of performing tasks remotely. Services became a focus of research, in which there was no concrete theory, but it was urgent to study and create methodologies. That is why Services Design starts to be treated as a new science. Associated with these changes, some new methodologies emerged and others were improved to include services' new characteristics. This project studies how Service Design, Business Process Management and Enterprise Architecture based in Information Systems approached companies' change programs.

These three areas are usually studied independently, even though they have many similarities. Each one has a different focus, but all of them intend to improve efficiency and service level. In this research, it was studied how these approaches intersect and how a project can have all of them in consideration.

One of the HEI that started a program of service improvement was Porto's Polytechnic Institute (Instituto Politécnico do Porto – IPP). A planned project was developed to implement an ERP and SRM (Student Relationship Management) systems, Student Management System (Sistema de Gestão de Alunos – SGA) and Online Secretary (Secretaria Online – SO) respectively. The first stage was to implement it in the Administration and Accounting Institute (Instituto de Administração e Contabilidade do Porto – ISCAP), one of IPP's schools. Currently, 15 years later, the system is fully operative in all but one school of IPP and went further than predicted. This project can't be considered as static since it is based on technology, thus it is always evolving. In fact, in the last 5 years more functionalities were added to the platform.

This research was based on ISCAP current situation. It starts by describing the current services offered online and the information system that supports those services. Then, it analyses the processes that are most common and which ones are already supported by the IS. Based on online surveys, communities' opinion about the service and its usage is also taken in consideration.

Performing an exploratory research, this project aims to study how Services Design and Enterprise Architecture can be used together in a Business Process Reengineering program based on the hypothesis that their methods can be merged. The case study uses information from ISCAP so that a real situation is tested in the context of the proposed methodology.

This methodology includes phases from the different frameworks and methods, trying to approach the issue from internal and external perspectives. From the Services Design theory it is possible to include the client perception about the service; and from the Enterprise Architecture theory is it possible to improve company efficiency with the usage of Information Systems.

Section 2 presents some theory used to support the project. From the Business Process Reengineering it presents how it has been used in HEI and some critical success factors. Related to the Information Systems, the concepts of ERP and CRM are presented and it is described how they are currently adopted for the education paradigms. About Enterprise Architecture some selected frameworks are described, namely, The Zachman Framework for Enterprise Architecture, The TOGAF method, the FEA framework and the Gartner framework. Also the Enterprise Architecture Planning and Enterprise Architecture Design serve as a base to the methodology followed during the project.

Section 3 presents the Institution and its current technology support. Section 4 details the methodology and data collected. That data is then analyzed in section 5 and finally the proposed Process Reengineering is presented in the section 6. This section represents the practical contribution for the company.

Still, the main contribution of this project is the usage of existing synergies between the Multilevel Service Design method and the Enterprise Architecture Design framework and its integration in the Zachman Framework.

Finally, the last section presents the conclusions to be taken from the project and some proposals for the future.

## 2 Services Management Perspectives

BPM and ISA are the two of the most popular management frameworks among HEI. Since technology started to be available for HEI, schools have tried to improve quality by implementing IS and/or defining a process based management system. Ideally the two should be used together (Ahmad, Francis, and Zairi 2007, Allen 1995), even though some IS are implemented without a previous analysis of processes (Pollock and Cornford 2004).

An issue sometimes left behind is the interaction with customers (students in the context of HEI). Services Design methods can be useful because they consider the user experience, whether it is with a physical service interface or a virtual interface via IS. This can be studied by applying the Service Experience Blueprint method, used to design the service encounter in the Multilevel Service Design method.

Many frameworks offer management tools, some focused on enterprise practices other focused on customers' satisfaction, depending on the mission and vision of the administrative board and the industry sector. In services, it is important to create a well-defined set of rules for the company's own workflow assuring efficiency (Davenport 1993), but also to manage customers' expectations by understanding their perception of service quality (Zeithaml, Berry, and Parasuraman 1993).

The referred frameworks claim that the best way to implement quality is to start with processes definition. Whether it is by processes redesign and change implementation and management, whether it is by processes documentation and defining the system architecture based on those processes, or even by letting the customer define the best journey for him/her and design the service according to the best service level.

Though, these frameworks assume that a significant innovation is possible. For achieving the best level of service with employees' efficiency and effectiveness, and customers' satisfaction, the solution is to redefine processes "from beginning to end, employing whatever innovative technological resources are available" (Davenport 1993). This methodology may help improving reductions in time and costs and increasing service levels and quality.

For ISA, the Zachman's framework suggests a similar structure by defining company's strategy and its processes. This assures that performed tasks will be aligned with the goals previously defined. Finally, IS must be built based on those processes; from stored data, applications that manage that data, and technological support to those activities (Velho 2004).

The problem arises when there are no funds to invest in new technological resources. In those cases, a possible approach to improve quality and implement innovative processes is through what might be called reverse engineering. Starting by analyzing current information system architecture and its potentialities, then it is possible to define efficient and effective processes. In some cases it will even be possible to implement new system applications with low investments, without no need for new technology.

The proposal of using Service Design methods is justified by the need of considering all stakeholders. When managing services, these methods are more customer focused. The Multilevel Service Design method includes designing the service concept, the service system and the service encounter. All of this with the understanding of the customer's experience (Patrício et al. 2011). Therefore an integration of Service Design methods is suggested.

Since the objective of this project is to integrate the IS and Service Design methodologies and both rely on the Business Processes analysis, a description of these three perspectives is presented in this section.

## 2.1 Business Process Management

This section describes Business Process Management (BPM) or Business Process Reengineering (BPR), and how it can help strategy implementation. BPM is used to improve efficiency and effectiveness for internal tasks (Davenport 1993). Some studies have addressed critical factors of success in order to achieve the desired goals during the project. Authors have studied how process innovation may or not be successful, based on practical cases.

The first aspect to have always in mind is that, despite the type of institution and the level of reengineering, the mission and vision must be well defined and embedded in the daily tasks. There is no gain in defining mission and vision and then define tasks that are not in accordance with them. When engaging a project of BPR, it will be necessary to pay attention to change management (Davenport 1993).

The economic situation is affecting how companies establish their strategy. Their goals are kept constant, but the path to achieve them is changing (Trkman 2010). Process innovation has shown to be quite helpful in reducing costs or time; in improving quality and increasing service level (Davenport 1993). Although there is not substantial theory supporting BPM (Trkman 2010), a processes perspective has been in use for a long time.

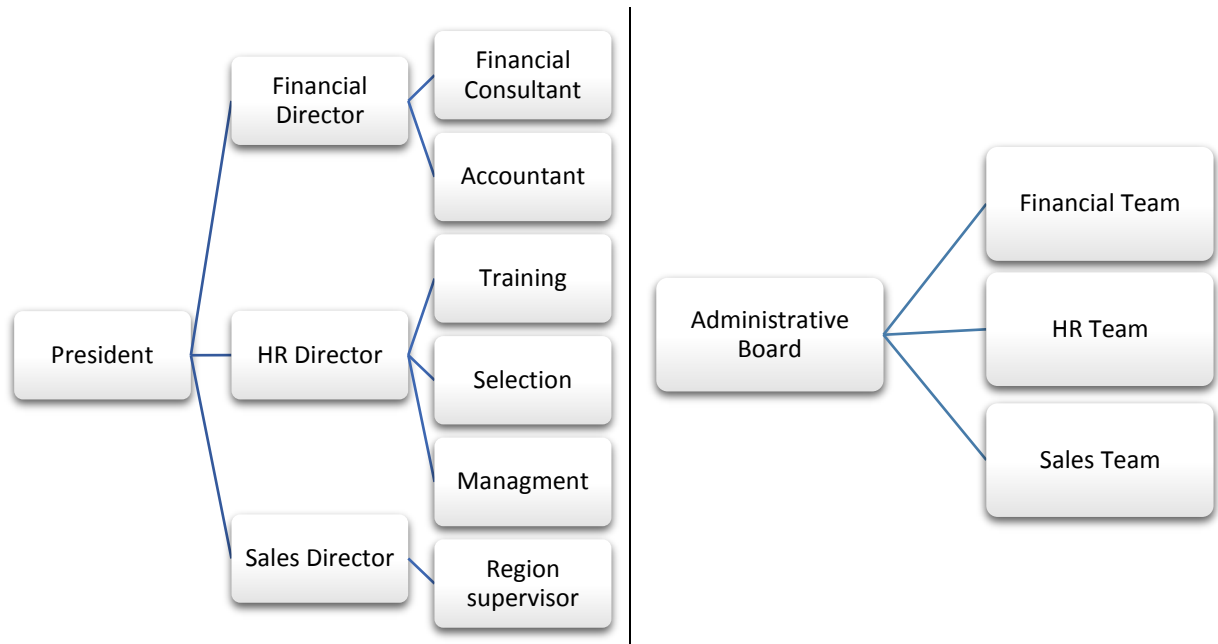
Before understanding how managing processes can be helpful in defining a service or product provision, it is important to understand what a process is. A process needs inputs and creates outputs (Figure 1). The tasks performed that transform the inputs in outputs constitute the process (Sharp and McDermott 2008).



**Figure 1. Process transformation from inputs to outputs**

Managing a business through a process perspective gives emphasis to the how the work is done, i.e., how the product is developed and how the service is provided more than what product and service is being offered (Davenport 1993). When an institution applies this concept, it is easily understandable that there is no need to innovate too much in what services are offered, but in how the service is delivered. This can be applied specially to HEI that are based on a set of standard services. The inputs and outputs will hardly change in HEI, but the way the work is done can be improved by reorganizing processes.

Another important characteristic of a process driven company is the inexistence of barriers between departments as processes are cross-functional and not compartmented in only one department (Pereira and Castro 2012). In fact, the idea of creating cross-functional processes is aligned with the idea of involving employees in the strategy of a company (Trkman 2010, Ahmad, Francis, and Zairi 2007), therefore a typical process oriented company will have a more horizontal structured than a traditional hierarchical one (Figure 2).



**Figure 2. Hierarchical vs Flat Organization Structure**

Davenport distinguishes two different levels of change. If processes go under small modifications increasing efficiency and effectiveness there will be a lower level of change than if processes are radically changed (Davenport 1993). Hence, process innovation implies completely rethinking how work is done. When starting a BPR project, it might be helpful to firstly decide whether the approach should be radical or incremental (Table 1).

**Table 1 Process Improvement versus Process Innovation (Davenport 1993)**

	Process Improvement	Process Innovation
<b>Level of change</b>	Incremental	Radical
<b>Starting point</b>	Existing processes	Clean State
<b>Frequency of change</b>	One-time/Continuous	One-time
<b>Time required</b>	Short	Long
<b>Participation</b>	Bottom-up	Top-down
<b>Typical Scope</b>	Narrow, within functions	Broad, cross-functional
<b>Risk</b>	Moderate	High
<b>Primary Enabler</b>	Statistical control	Information Technology
<b>Type of change</b>	Cultural	Cultural/structural

It may be tempting to consider process innovation the best option, but when working in a HEI it is not so simple to decide between improvement and innovation. In a first stage, process innovation would be better since it could implement cross-functional processes, breaking up with traditional views of processes. On the other hand, it would require a cultural change, which is hard to achieve in older schools. Though, the main constrain would be the fact that some academic processes cannot be changed completely.

That is why, in most cases schools adopted IT imposing new processes (Seeman and O'Hara 2006). Even if the workflow is kept, task distribution among participants and the way participants communicate with each other changed. This can be seen as an example of process innovation, despite the fact of not changing the workflow.

For BPM, IT is considered an enabler, and it will be described as so in section 2.2. Concerning IT influence on BPM it is important to retain that it is in fact an enabler but it can be also a constrain as it can impose workflows and interactions channels. Also the required investment can appear as a significant obstacle to perform a successful BPR project. In fact, many projects fail without even being completely implemented. Despite the low success rate when implementing changes, usage of BPR and technology change show as the two highest success rates (Ahmad, Francis, and Zairi 2007)

One important factor to keep in mind when developing this type of project is that business processes (BP) must represent the institution's strategy, enabling its execution. Focusing only in processes and IT and ignoring other factors may be one of the reasons for failure (Trkman 2010).

BPM faces several challenges, depending on the level of change that a company wants to achieve. There are four main challenges inside the institution: organizational, managerial, information systems and social issues (Trkman 2010). To be successful with BPM, the responsible team must consider the critical success factors (CSF) that will vary accordingly to the type of institution (Trkman 2010, Ahmad, Francis, and Zairi 2007).

Trkman presents a case study that gathers three different theories that support BPM and are helpful when determining CSF (Trkman 2010). The contingency theory states that there must be a perfect fit between business environment and business processes. In other words, the strategy and structure must be aligned with the competitive environment in order to be effective. The dynamic capabilities theory claims that proper organization is needed to assure benefits from the project, otherwise it will be likely to fail. Therefore, the institution should evaluate which are its core competences and value them in the process definition. This is in agreement with the previously described idea that BPM must be not only an innovation process but also a commitment with improvement. To reach the level of desired service level technology is an undeniable resource. This leads to the third theory, Task-Technology Fit. IT role in BPM is critical as IT resources must fit the processes to be performed. If IT does not match the tasks, the process it already failing due to lack of resources. The idea of IT as a competitive advantage is decreasing as companies have easy access to it. Some even state that IT does not matter, and only the way that it is used can bring advantages to the company, since it has become a commodity (Carr 2003). So, the alignment between IT and BP might help to achieve some advantage.

Ahmad et al (Ahmad, Francis, and Zairi 2007) also studied CSF and focused on HEI. When compared to Trkman's case study it is possible to conclude that CSF can be grouped in four categories: Project Management, IT/IS, Financial, People (Table 2).



**Table 2 Critical Success Factors comparison (Trkman 2010, Ahmad, Francis, and Zairi 2007)**

Categories	Tkrman	Ahmad et al
<b>Project Management</b>	Strategic Alignment Quality Measurement Organizational Changes Continuous Improvement	Quality Management Satisfactory Rewards Effective Change Management
<b>IT</b>	Standardization Automation Informatization	Information System
<b>Financial</b>	Investment	Investment
<b>People</b>	Employees' Specialization Attribution of process owners Empowerment Training	Teamwork Quality Culture Less Bureaucratic Participative

Managing people is presented as critical in several stages. During the process definition, because the process has to be designed according to the human resources available, but when using people as resources the human factor is very important. People are not machines and cannot be treated like so. Also, employees' recognition and empowerment shows as an important factor since process success depends on employees' dedication and motivation (Ahmad, Francis, and Zairi 2007). Thus, people can be considered enablers (Davenport 1993), or an obstacle (Ahmad, Francis, and Zairi 2007) for the BPR project. Like IT and IS, the definition and distribution of tasks among employees is crucial as it can determine if the work flow is efficient or not. From this, it is easily comprehensible the need of involvement from top management leading the BPR project, thus the importance of the leadership and change management (Ahmad, Francis, and Zairi 2007).

When applying this type of framework to a HEI, it is important to consider its structure and evaluate the possibility of adapting it to become more flexible. A BPR project always should have an impact in the organization's rethinking. When in a HEI, this is no exception. Traditionally schools are more hierarchical but it is possible to implement cross-functional strategies with the proper IT support, since reengineering and IT are complementary (Ahmad, Francis, and Zairi 2007).

Some failure cases can be associated with several mentioned factors, thus the need of planning and analyzing resources before undergoing a project such as BPR. Implementing a process perspective in an organization should be progressive. Each process has its own details, but they are also interrelated. The best process is the one that is flexible and can respond to requirements. To know those requirements, employees must be involved in all the decision making process, and work as a strong team. In other words, there is much more to BPM success than just cost and time reduction (Ahmad, Francis, and Zairi 2007).

## 2.2 Information Systems

One aspect to keep in mind is that, when undergoing a change processes that includes implementing a new IS or developing a new service through Information Technology (IT), the guide lines must be set up at the beginning while defining the strategy. Since the mid 90's that it is widely accepted that IS has its own strategy because it is dependent on several aspects, including stakeholders and environment. In the UK, institutions were encouraged to implement new IS management systems by developing Information Strategies (Allen 1995).

When approaching the management issues through IS the tendency is to apply ERP and CRM adapted for the HEI. In order to achieve success when applying them, it is important to establish a parallel between the industries where ERP and CRM are usually used and HEI (Pollock and Cornford 2004). An ERP is a modular management software that allows the integration of several applications used to manage people, resources and activities. CRM, as the name suggests, is not only a resource but a concept used for managing relationship with customers. It usually has an important role in attracting and retaining customers (Seeman and O'Hara 2006, Piedade and Santos 2008).

Pollock and Cornford explain how ERP systems can be used in HEI by adapting each module to the characteristics of a university (Pollock and Cornford 2004). ERP systems come from the industrial sector where manufacturing and resources planning gave origin to materials requirements planning (MRP) systems. But its versatility became one of the most important factors for it to be used in several contexts. Having in mind that Universities are organizations, a system similar to ERP can be developed to solve issues common to all organizations. In the end, it will depend on a correct customization of the ERP (Pollock and Cornford 2004).

An ERP is developed with the idea of integrating all functions of the organization, implying that the first aspect to have in consideration when implementing one is what services and processes it will support. This is an important stage, because adopting a system without any customization may impose processes and organizational structure that are not aligned with reality (Beard and Sumner 2004). Some activities can be inefficient when implemented, other can be assigned to the wrong people, and also, if there is no communication, responsibilities may not be clear.

In the case of universities this is even more important given that university academic processes will be entirely different from a common organization. For a HEI, an ERP can be useful when managing students personal information and their academic data such as grades history, requests, classes taken; human resources and equipment maintenance. It is clear that it should include a financial module.

One other important role of IS in management is the communication with consumers. In the case of HEI the concept of CRM might be expressed as SRM considering students as customers. This can be a competitive advantage since it improves the relationship between the institution and the student (Seeman and O'Hara 2006). The concept and practices of CRM itself include the integration of all business areas that interact with customers. The idea is to have a complete view of customer's activities and needs and use that information to create a customized service (Lechtchinskaia, Friedrich, and Breitner 2012). Satisfaction and loyalty can also be improved once the service is designed to better communicate with clients, these will perceive better quality from the service and have a better service encounter experience (Seeman and O'Hara 2006).

Technology to manage relationship started to be used when commercial activities grew and keeping customers' data became more complex. While the competition was getting heavier, companies needed a way to focus on their customers, therefore the existence of a system that could help in operational and analytical areas appeared as an opportunity to implement a customer-centric strategy (Seeman and O'Hara 2006).

When applying this concept and system to HEI, the first stage is to understand who are the customers and what activities the system will support. As already mentioned, students are the customers, thus the system should be student-centric. So, developing a SRM system means understanding students' activities and interactions with the institution and how it is possible to improve that experience (Lechtchinskaia, Friedrich, and Breitner 2012).

In terms of technology the system should provide good external communication. Quality can be achieved by dedicated employees helping students or having the required information on the system. The factors of trust, commitment and perceived quality are found to be important indicators of quality when related to students' satisfaction (Lechtchinskaia, Friedrich, and Breitner 2012).

While CRM systems may include marketing, sales and after sales activities, ERP systems provide the tools to manage the information about clients. The integration of ERP and CRM systems seems useful since data collection and data analysis are essential to achieve good results when improving customer relationship. These systems can give the company a wide sample of information that can be after be used to develop new capabilities and competences (Piedade and Santos 2008).

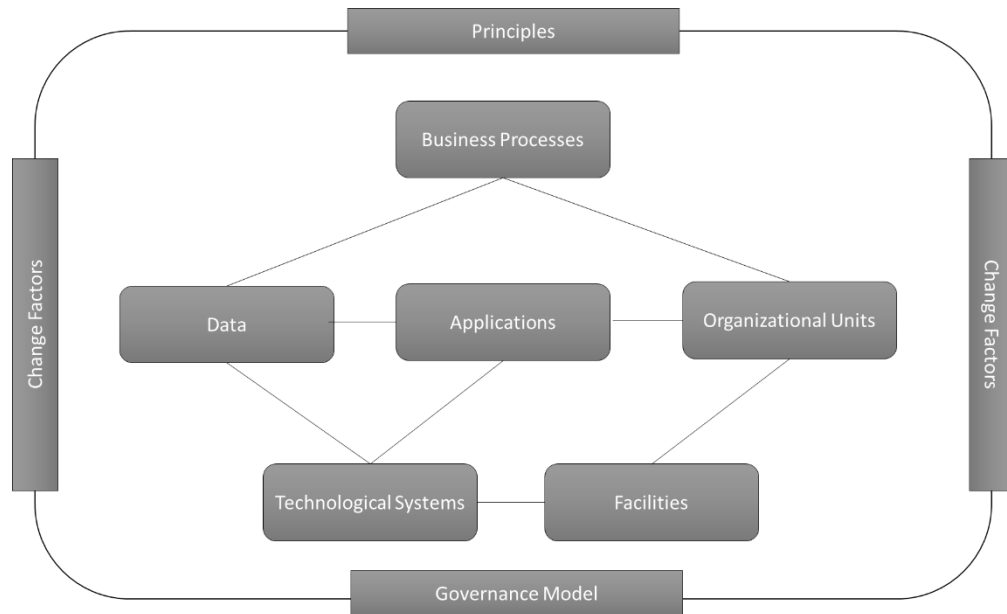
One of the ideas behind SRM is the student life cycle (Lechtchinskaia, Friedrich, and Breitner 2012). According to these authors, there can be considered three major stages: student acquisition, student retention and alumni retention. This can be associated with Service Design methodologies rather than Information Technology, and will be explored in other sections.

HEI can take advantage of the fact that technology is becoming more widespread with mobile access to internet. 21<sup>st</sup> century students are well familiarized with several types of devices and the usage of IT (Milliron 2001). Hence, the usage of IT in HEI is well justified. The access to information all the time and everywhere is nowadays a requirement for all IS (Seeman and O'Hara 2006). This can be done through ERP and SRM integrated systems.

### **2.2.1 Enterprise Architecture - Information System**

An Enterprise Architecture (EA) Framework has the objective of mapping the software development processes for a certain enterprise and their relations and interactions (Urbaczewski 2006). In the end, it is a group of artifacts and objects that are important to represent the enterprise, which are used to support the business software development, implementation and management, mainly during a period of change (Velho 2004). Even though the intention of this project is to discuss Information Systems, due to the high dependency of modern business on IT, Information Systems Architecture cannot be easily separated from the company using them. This justifies the inclusion of Enterprise Architecture in this section.

An EA is composed by six main elements (Figure 3) that relate to each other (Velho 2004). Those elements are the ones focused by the frameworks described hereafter. Some approaches propose how to define each component, other propose what should be developed in each one.



**Figure 3. Key Components of Enterprise Architecture (Velho 2004).**

Enterprise Architecture appeared as a form of aligning IT with the companies' processes. As referred in section 2.1, IT and processes alignment is considered a CSF. So, in order to turn IT into a facilitator of the processes, the Information System should be defined according to company's strategy and needs. EA can be seen as a "blueprint for system and the project that develops it" (Urbaczewski 2006). In other words, as a bridge between strategy and implementation, bringing together Business Architecture and Information Systems Architecture (Velho 2004).

IT usage in business has evolved in different ways since it first appeared in the 50's. The role of IT in enterprises can be divided in five eras (Applegate, Austin, and McFarlan 2007, Velho 2004). When they first appeared information technologies were used to help in specific tasks by automatizing them and standardizing results. The only goal was efficiency and not effectiveness. Twenty years later, the change to the second stage became visible since IT also started to help with effectiveness. The importance was not only in the result anymore. The information managed mattered and it was used to improve task execution. Then, by the third stage, IT becomes a strategic line of the business, i.e., IT goes from being a tool to perform tasks to being a strategic business partner. This era can be associated with the competitive advantage using IS. Differentiation through IT shows its potential; therefore business strategies are aligned with IT strategies. By the end of the 20th century, advantages of strategic IS were globalized and not so competitive. The new advantage was not achieved by using IT, but by using information systems integrated with the business. This was done by integrating several systems and managing all the information provided by them. The idea is to establish synergies of different systems that are essential to the business and use them in a way that gives advantage among competitors. Finally, the facilitated access to internet brought a new leap to the way businesses used IT. The concept of electronic business starts to be used and companies start to create networks, like a business web. Internet is now the support to the business and the business itself is completely dependent on technology, with all the main support being electronic. The business and the technology can't be separated and integration is the key-word for the current era (Velho 2004).

In spite of mentioning dates to each era, there is not a sealed date. As always, change is a process and may take several years to occur, causing the mentioned eras to co-exist (Table 3). Currently, with mobile internet, businesses are also integrating mobile services. Again, integration and innovation are a key point to differentiation.

**Table 3. IT Role Evolution in Organizations (Velho 2004)**

Strategy	Era		Target	Purpose	Reference dates
<b>IT are the business</b>	V	Electronic Business	Business Web	Business Model Innovation	1999
<b>IT are a strategic partner for the business</b>	IV	Integrated Information Systems	Organizational Integration	Organizational Effectiveness	1995
	III	Strategic Information Systems	Products/Services	Competitive advantage	1985
<b>IT serve the business</b>	II	Management Information Systems	Results	Individual/Group Effectiveness	1970
	I	Task Automation	Tasks	Efficiency	1950

Several frameworks have been proposed and adapted along the years to design and plan an Enterprise Architecture for specific areas of study. All of them aim to help companies defining how to implement strategies by making use of IT. This section gives a brief description about some of them with the intent of later comparing and exploring a blended approach of all. Each one of them have different foci and approach for Enterprise Architecture (Sessions 2007), Table 4. Being so they can be classified in taxonomy, methodology, process or practice.

**Table 4. Frameworks' foci and categories**

Framework	Focus	Type
<b>Zachman's Framework</b>	Players and Perspectives	Taxonomy
<b>The Open Group Architecture Framework (TOGAF) – Architecture Develop Method (ADM)</b>	Process phases	Process
<b>Federal Enterprise Architecture</b>	Reference Models and process	Methodology
<b>Gartner Methodology</b>	Strategy	Practice
<b>Enterprise Architecture Planning</b>	Planning	Methodology
<b>Enterprise Architecture Design</b>	Strategy and Governance	Methodology

Due to some misinterpretation of the term framework and for a clear understanding of the description it will be defined architecture taxonomy as an ordered group or categories of artifacts; architecture methodology as a step-by-step process to design the needed artifacts; framework as a structure of the work to be done; and practice as the execution of any methodology. In general all of approaches here described are mentioned as frameworks.

As it will be explained, they all have their strengths and weaknesses. It is not correct to say that one is better or complete and the others are wrong. In fact, in many cases, the ideal situation is to adopt an integrated approach, gathering the strengths from them all, compensating the flaws (Sessions 2007).

#### **2.2.1.1 Zachman's Framework**

Zachman Framework for Enterprise Architecture is considered the first EA and the beginning of EA's history. It approaches the design of EA by looking at every important issue from every important perspective. Zachman first described his work as a Framework for Information System Architecture, but once it represents the enterprise and not only the information systems, it was changed to Framework for Enterprise Architecture (Sessions 2007). The need for a framework at the time (1987) was justified by the increasing complexity of IS and dependency of enterprise on them (Urbaczewski 2006).

This framework is based on comparing the construction of a IS to the construction of a building. The original framework presented five perspectives, from the owner of the project to the sub-contractor, like in a physical construction, including planner, designer and builder (Velho 2004, Urbaczewski 2006, Spewak and Hill 1993, Sessions 2007). For each of these perspectives it mentions the documentation to be produced in order to answer some questions about the project:

- What?
- How?
- Where?
- Who?
- When?
- Why?

This type of organization gives the Zachman's Framework the potential for being well understood by cross-functional teams. It can be shown as a matrix (Figure 4) in which the perspectives of each player can be associated in each row and the focus for each question in one column. Each player perspective is associated with a level of detail, increasing when moving vertically from top to bottom (Sessions 2007). The level of detail is related to the type of document produced, being visible the distinction between business processes, entities, application and technology (Zachman 2009). Zachman himself mentions the fact that no architecture is completely right or completely wrong, therefore they need to be used together (Sessions 2007).

The co-existence of the different perspectives is one of the reasons for this framework's success. In fact, it has currently more than one version. It was recently modified to include what some call the user perspective (Urbaczewski 2006, Zachman 2009) or the role of workers in a construction, being related to operations to be performed (Figure 5).

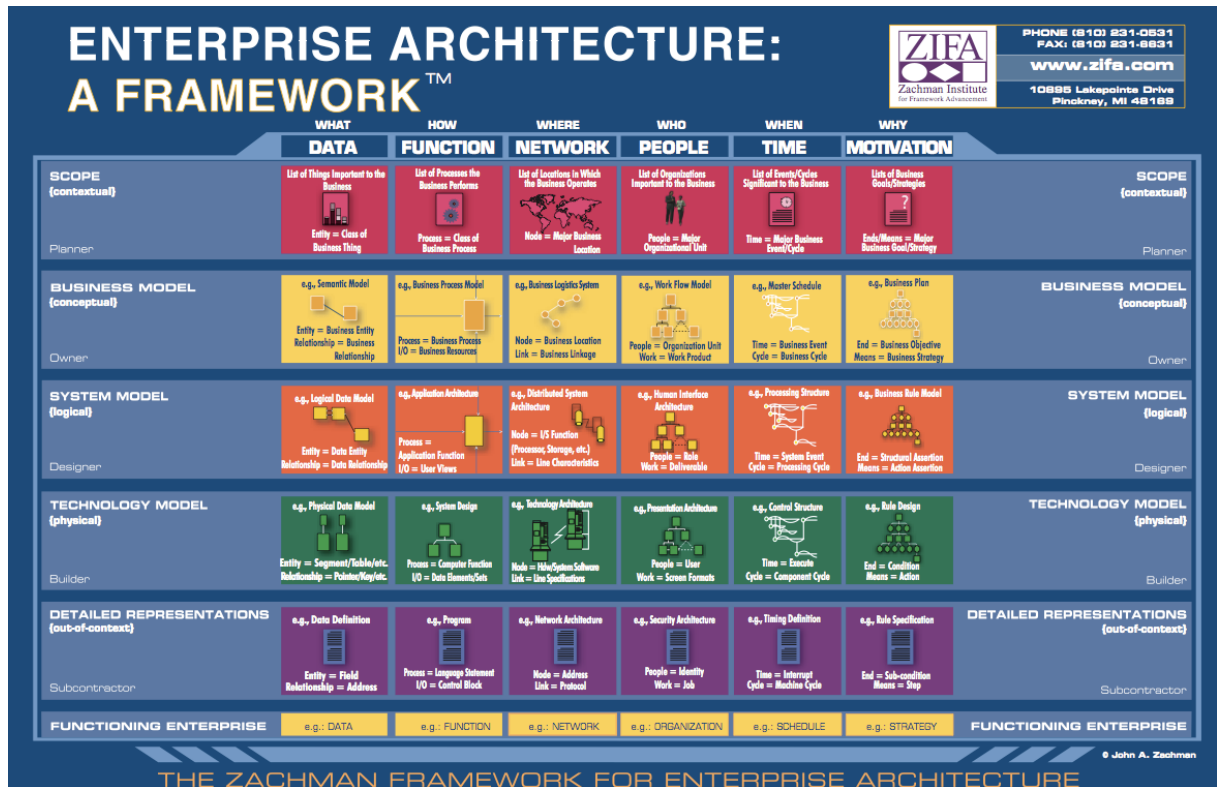


Figure 4. The Zachman Framework for Enterprise Architecture (Zachman 2009)

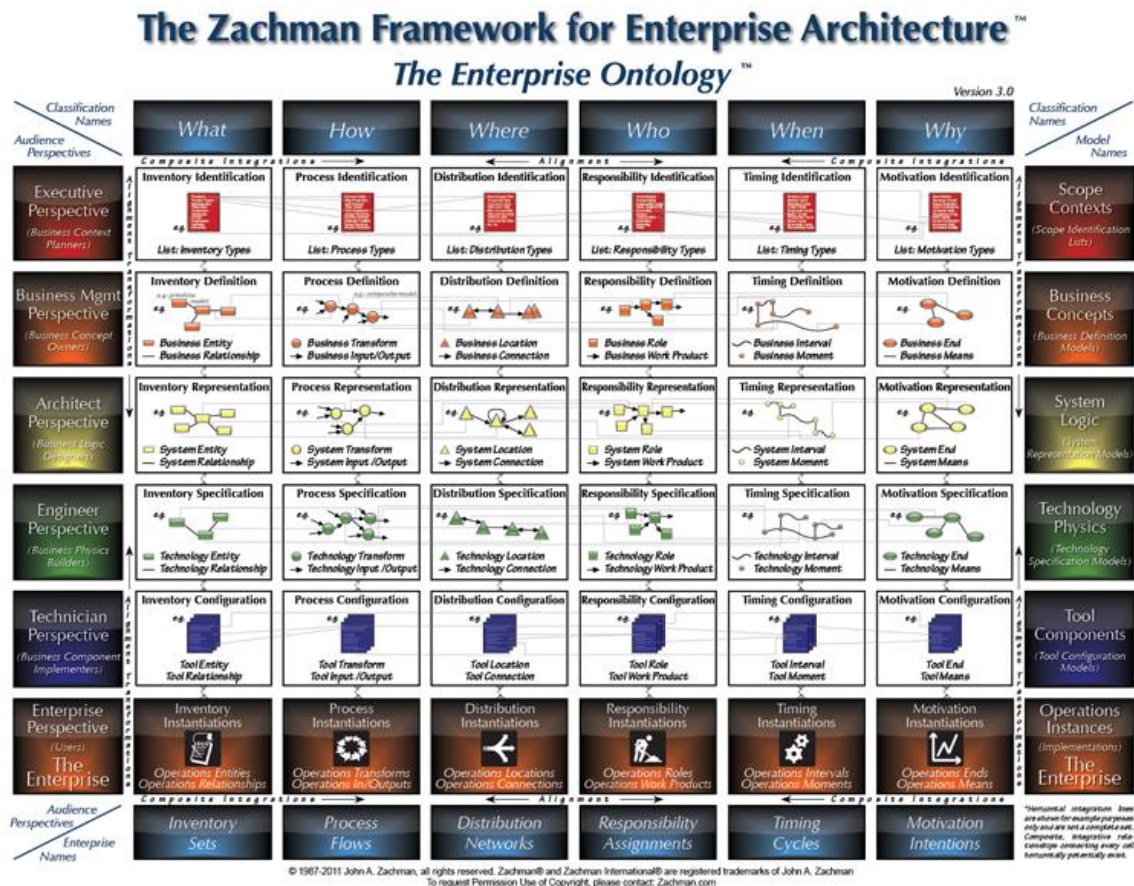


Figure 5. The Zachman Framework for Enterprise Architecture version 3 (Zachman 2009)



### 2.2.1.2 TOGAF – Architecture Develop Method

The Open Group Architecture Framework (TOGAF) divides an EA in four categories. In some aspects they may remind Zachman's perspectives due to the different level of detail. TOGAF focus in four different categories, (Sessions 2007):

1. Business Architecture – is related to processes
2. Application Architecture – is related to IS applications
3. Data Architecture – is related to entities
4. Technical Architecture – is related to software and hardware

The most important part of this framework is the Architecture Develop Method ADM. As the name suggests, it is a step-by-step process to implement an EA. The Open Group approaches the EA as if it was a continuum of architectures, going from a higher level to a more detailed level of specification. The ADM is the process that helps the definition of each architecture. Considering only the ADM, one of its advantages is flexibility. TOGAF proposes a sequence of phases to implement the architecture or its change (Figure 6) but the order can be modified according to the needs and specifications of the project. The only aspect that is mandatory is the Preliminary Phase to define the project, its principles and adaptations from ADM. The scope and phases must be clear to everyone involved in the project. Most likely Phase A will be also a constant as the vision should be known before starting to create any of the sub-architectures (Sessions 2007).

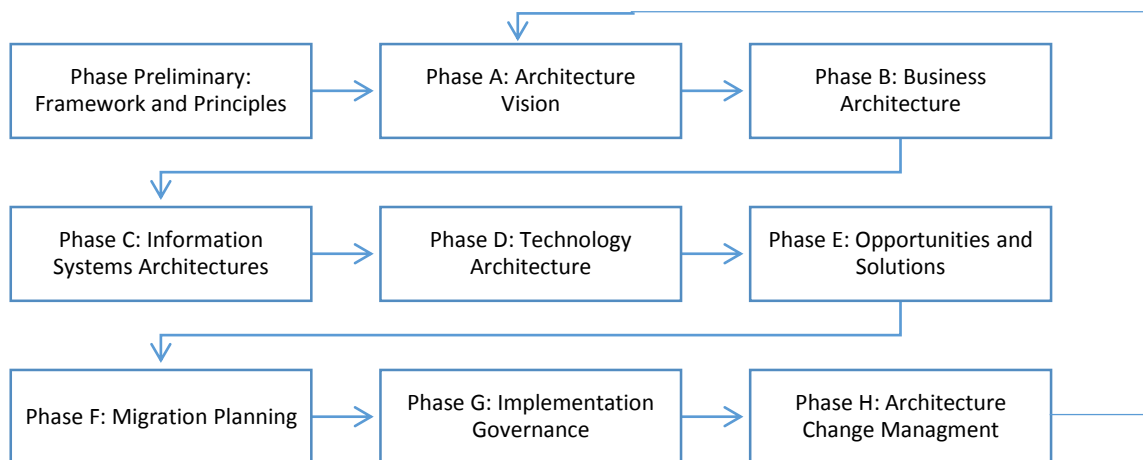


Figure 6. The TOGAF Architecture Development Method (Sessions 2007).

### 2.2.1.3 Federal Enterprise Architecture

The Federal Enterprise Architecture Framework (FEAF) comes from the US Government to manage its agencies as one by creating a unique EA. When compared to the previous frameworks it is more complete since it includes a taxonomy as Zachman and a process as TOGAF (Sessions 2007).

In the context of this project, the characteristic that is more interesting is the segment concept. According to Roger Sessions, a segment is “line-of-business functionality” and there are two type of segments: core mission-area and business-services. The first is specific of a part of the organization (eg.: Resources Management), it also can be seen as an enterprise inside the main enterprise, and the second is common to all the organization, e.g. Human Resources. FEAF also includes the concept of services that differ from segments in focus. Segments' focus is broader



than services' being the first associated with enterprise architecture and the latter with technical architecture (Sessions 2007).

The FEAF also created FEA Process, which is also a step-by-step approach of the Architecture implementation issue. It starts by creating a segment architecture for an agency, i.e. a department of the enterprise. At a high level it can be described in four steps (Table 5). When compared to the TOGAF's ADM, these four steps can be associated with TOGAF's phases, from the analysis of the vision and strategy to the implementation, including the architecture itself (business, data, services and technology), investments and management plans (Sessions 2007).

**Table 5. FEA Process steps and brief description (Sessions 2007)**

<b>1</b>	Architectural Analysis	Vision definition and association with organizational plan
<b>2</b>	Architectural Definition	Architectural definition of the desired segment, goals' performance documentation and EA development
<b>3</b>	Investment and Funding Strategy	Funding strategy selection
<b>4</b>	Program-Management Plan and Executive Projects	Management and implementation plan creation

#### **2.2.1.4 Gartner**

The Gartner framework is associated with the practice concept due to the fact that Gartner does not care about the process or taxonomy, these are only tools used to implement an EA. The practice is the correct way of using those tools.

For Gartner, "architecture is a verb, not a noun" (Sessions 2007). This means that the definition and implementation of an Enterprise Architecture is not a moment in the company's life, but a process that includes the creation and maintenance of the EA.

The focus of this framework is the strategy. For Gartner, bringing together business owners, information specialists and technology implementers is crucial in the beginning of the project. With the union of these groups, the chances of a successful implementation are higher, since their vision of the business will be the same. In other words, no matter what process is followed if the goals are not well defined. The strategy is the path to go through to get to the goals (Sessions 2007). Then, it is possible to define the tools to implement such strategy. As mentioned, those tools can be other frameworks.

Roger Sessions summarizes Gartner's view by stating that the two most important things are "where the organization is going and how it will get there". So, it is not about engineering but about strategy (Sessions 2007). The idea is to have one organization, one strategy vision common to all members. Clearly, the involvement of the leaders will be crucial when defining the strategy.

### 2.2.1.5 Enterprise Architecture Planning and Enterprise Architecture Design

Enterprise Architecture Planning (EAP) and Enterprise Architecture Design (EAD) are two very similar frameworks that try to gather the strengths of other frameworks, namely Zachman, TOGAF and FEAF. In fact, the reason for their resemblance is that EAD is based on those frameworks plus the EAP. EAP presents a complete methodology to plan the implementation of an EA (Spewak and Hill 1993) and EAD adds more detail to some phases of EAD, while merging other phases (Velho 2004).

Both begin with the planning of the project, where the vision and goals are defined. Then the business is described by modeling processes and functions. Only when the business characterization is complete the sub-architectures can be designed. After that, the final phases consider the implementation and change management (Velho 2004, Spewak and Hill 1993). EAP has a total of ten phases, while EAD adds the policy architecture in two phases – Management Information Systems and Technologies Principles and Governance Model (Table 6).

Table 6. EAP and EAD phases

High Level Phases	EAP	EAD
<b>Planning</b>	Initiation	Initiation
	-	Strategic – Operational Summary
<b>Current Situation</b>	Preliminary Business Model	Business Architecture
	The Enterprise Interview	
	Current Systems and Technology Architecture	Current Systems and Technologies
<b>Situation to be implemented</b>	-	Policy Architecture I – Management Principles
	Data Architecture	Data Architecture
	Application Architecture	Application Architecture
	Technology Architecture	Technology Architecture
	-	Policy Architecture II – Governance Model
<b>Implementation plan and change management</b>	Implementation Plan	Implementation Plan
	Planning Conclusion	Conclusion and Transition to Implementation
	Transition to Implementation	

EAP is usually presented in four layers (Figure 7), the same that are here adopted. But EAD considers eight layers. The reason to present only four layers is related to their purpose. Even though the policy architectures (I and II) are not completely associated with other architectures and are considered as independent layers by Vaz Velho (Figure 8), they also represent principles and models to adopt in the future when designing and implementing the new architecture. Although the Strategic-Operational Summary is included in the second layer, as it does not have plan activities, its purpose is to define the change factors. Hence, it was here included in the Planning layer since it does not contribute to the description of current situation.

In both frameworks the initiation phase is supposed to determine the project's scope. It also includes the definition of the chosen methodology, the work plan and the team involved in the project. One of the steps of this phase is IT Vision that mentions the approach of the company to the usage of IT, i.e. whether they are only tools or source strategic advantage and innovation (Velho 2004). It is in this stage that the commitment is made to enter the project by mobilizing all organization and making clear every stakeholder role (Velho 2004).

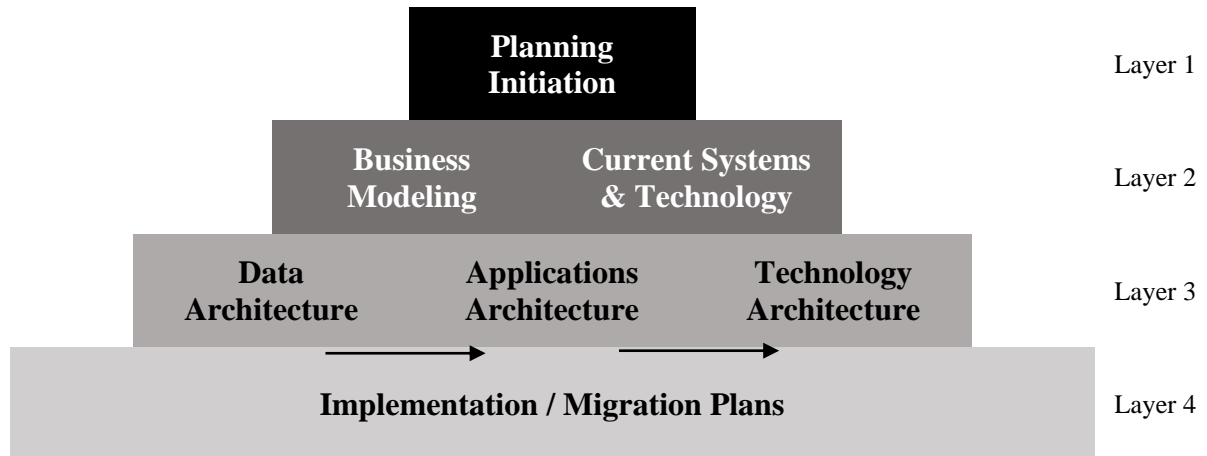


Figure 7. Components of Enterprise Architecture Planning (Spewak and Hill 1993)

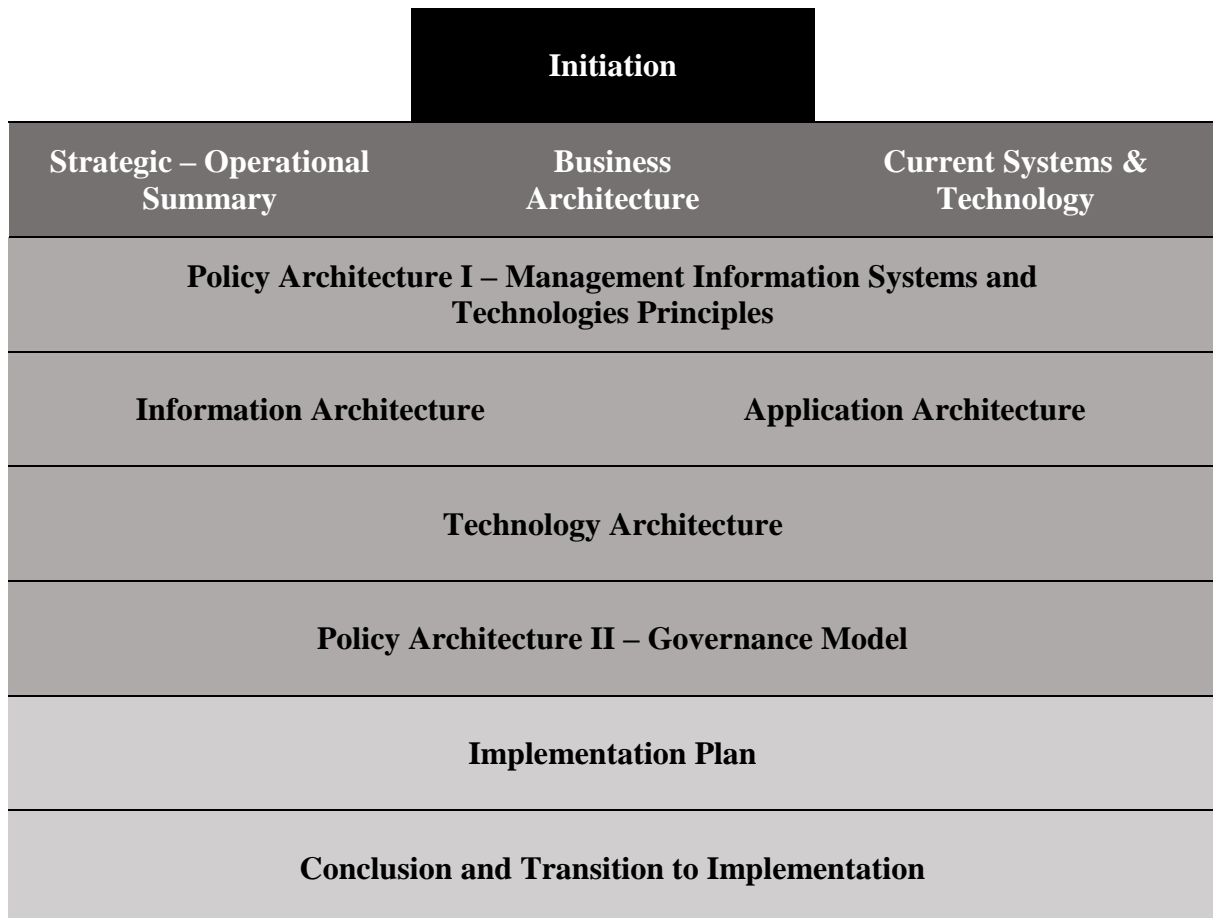


Figure 8. Architecture Design (Velho 2004).

For the EAP, it is important to state reasonable objectives and realistic expectations (Spewak and Hill 1993). The mission, vision and objectives of the projects are mentioned in the Initiation phase of the EAP, while the EAD only mentions the efforts to be made to make the project successful (Velho 2004, Spewak and Hill 1993).

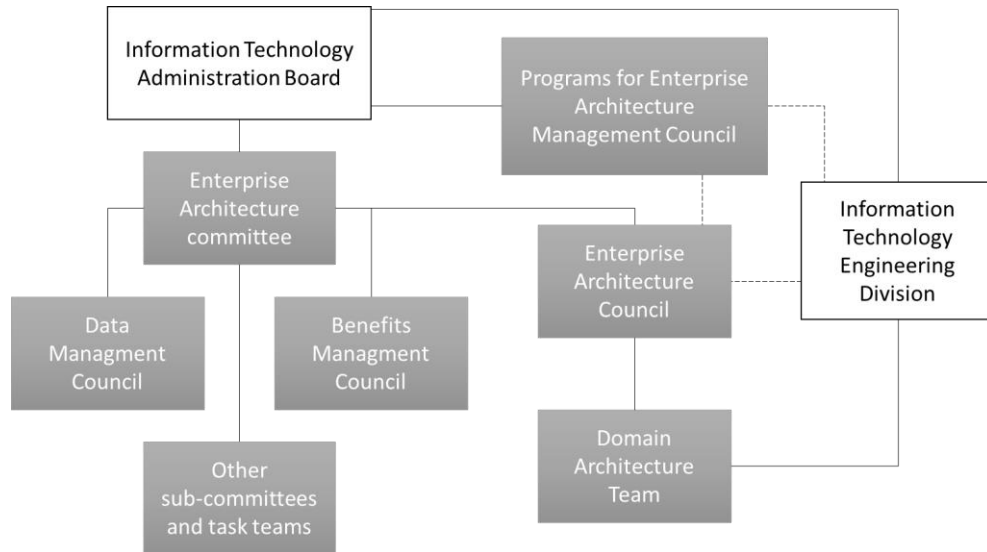
This leads to the analysis of one of the differences between the EAP and the EAD, the Strategic-Operational Summary. In the EAD, there is a phase dedicated to expose the mission, vision and values. It is in this summary that strategic and operational objectives are detailed (Velho 2004). When compared to the EAP, the existence of this stage makes the EAD more detailed in terms of goals. One advantage is also the fact that a result of the Strategic-Operational Summary are the change factors. They are the statement of the desired changes to implement (Velho 2004). The objectives are the state that the company aims to achieve, and the change factors can be associated with the strategy to be implemented so that those objectives are achieved.

In order to choose a correct strategy and to discover where the change is more needed, it is important to study the environment. The suggestion is to make an external and internal analysis, culminating with a SWOT analysis and the description of a possible competitive advantage. For Spewak and Hill this will be the beginning of the next stage, Preliminary Business Model, but for Vaz Velho, this is part of the Strategic-Operational Summary, due to the fact that to establish the correct change factors the company needs to evaluate the current situation (Velho 2004, Spewak and Hill 1993).

The Preliminary Business Model of the EAP can also be associated with the Business Architecture of the EAD. Though the Business Architecture goes deeper in the definition of the business model based on the results of the Strategic-Operational Summary, it is in these phases that the organizational structure and the business model are presented. The EAP finishes the description of the business processes after validating by interviewing the stakeholders, while the EAD includes the business model and business process in the Business Architecture. The Enterprise Interview phase of the EAP is dedicated to completing the business model by performing interviews. This comes as an advantage because the business model as-is is more accurate as the tasks' owners confirm it. Though, there is nothing in the EAD that excludes the validation of the Business Model developed in the Business Architecture with the stakeholders (Velho 2004, Spewak and Hill 1993).

In sum, the differences, the Preliminary Business Model plus the Enterprise Interview together are equivalent of part of the Strategic-Operational Summary plus the Business Architecture. Each one has its own advantages, since they have different levels of detail.

The remaining stages are quite similar to the TOGAF. Beginning with the definition of the data architecture until the implementation plan, including the application architecture and the technology architecture. The only difference is in the EAD that includes the policy architectures that define principles to create and manage the other architectures. The Governance model is detailed in the second Policy Architecture, before the implementation plan. The governance model distributes responsibilities about the maintenance of the architecture implemented. It describes several councils and their tasks (Figure 9). The level of complexity depends on the type of model chosen (Table 7) and the human resources available (Velho 2004).



**Figure 9. Governance Councils (Velho 2004).**

**Table 7. Governance Models – Davenport (Velho 2004)**

<b>Anarchy</b>	Absence of an information management global policy leading each individuals to obtain and manage their own information.
<b>Technocratic Utopianism</b>	A highly technical information management approach demanding the categorization and modeling of all information assets in the organization, depending on emerging technologies.
<b>Feudalism</b>	Absence of an information management global policy. The management of information is done by individual business units, reporting limited information to the overall corporation.
<b>Federalism</b>	An approach to information management based on negotiation and consensus of the organization's key information elements and reporting structures.
<b>Monarchy</b>	Definition of information categories and reporting structures by the organization leader that may or may not share information with the overall organization.

The transition and implementation strategy depends on the project's owner. It usually has a Gantt diagram with planned activities and deadlines. It also describes guidelines to follow during the transition period (Velho 2004).

Both methods have detailed information about all types of architectures and artifacts (appendix A). Since those are not the subject under study, the description did not include such details.

### 2.3 Multilevel Service Design

The perspectives from BPM and EA are both focused on internal efficiency and results. Nowadays the importance of their alignment is acknowledged, but the services' perspective is not always included. The focus of a Service Design Method is the customer and his/her experience. One of these methods is the Multilevel Service Design (MSD) that will serve as the base for this project. MSD is an interdisciplinary method or process used to design services from the high level (the service concept) to more detailed specifications (the service encounter), including the definition of customers interactions moments (the service system). It takes into account customer's requirements, enabling the integration of the customer experience in all stages (Patrício et al. 2011).

Services' complexity degree has been increasing, adding different stakeholders, different resources and different interaction channels. Then, a service can be seen as a service system with subsystems. In other words, a customer has several ways to interact with the main service - service system - as if each interaction was a different service - a subsystem (Patrício et al. 2011).

The coexistence of different interfaces is related to technology evolution and has led to the creation of multi-channel services, creating the paradigm of multi-channel services design and management. Another aspect to take into account when designing new services is the customer experience. Many companies have understood the need to deliver services in order to satisfy customer expectations and creating new experiences. Facing new technology and higher customer demands, service innovation became dependent on bringing together synergies from Management, Social Sciences, Computer Sciences and Engineering (Patrício et al. 2011).

The lack of unifying methods, models and languages justifies the creation of the MSD. One of its tools is the Service Experience Blueprint (SEB) that maps the service encounter based on management and technology perspective. Being focused on the service encounter level, it is not considered a complete method for the service design, but it can be considered a method for designing customer experience (Patrício, Fisk, and Falcão e Cunha 2008). Then, it can be used as a tool in the MSD, at the lower level.

The MSD method is divided in three major levels already mentioned (Figure 10). For each one, there are different tools and consequently several models result from each phase.

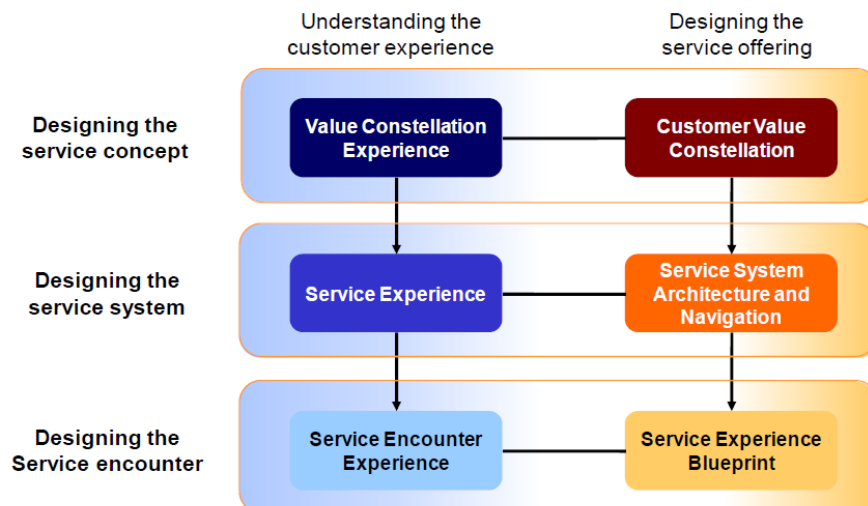


Figure 10. Multilevel Service Design scheme (Patrício et al. 2011).

It starts by defining the value offering and benefits for the customer. This is done by understanding the customer experience, preferably engaging customers in the design process. The process leads to the definition of the Service Concept and from here results the Value Constellation Experience and the Customer Value Constellation (CVC). The first is centered in understanding customer experience, and the other in designing the value offer, both at a strategic level. In other words, these models represent where the service is positioned and how it relates with other services. It can be compared with the definition of core and supplementary services, but in the customer perspective (Patrício et al. 2011).

The next level is the Service Experience Design that focus on the main activities performed by the costumer in which there is interaction with the firm. Again, it is important to involve customers with participatory design methods to validate the set of activities considered at this stage. From the Service Experience result the Service System Architecture (SSA) and Service System Navigation (SSN). At this level it is interesting to introduce the concept of customer journey. As the name suggests it describes all the customer activities to reach the desired service. It may include different channels and it may happen throughout the service delivery process. The customer journey will lead to a good or bad service experience, since the experience results from all the interactions with the service provider at all times and in every interface (Patrício et al. 2011).

The SSA (Figure 11) represents the structure of the service system. In the top row the major phases for the process of a certain service are presented and the first column should include all the possible actors in those phases (Patrício et al. 2011). It is divided in three main layers: the customer, the front office with which the customer interacts, and the back office representing the participants that influence the service delivery but do not interact directly with the customer. For each main activity of the top row and for each actor, tasks are distributed according to the customer needs analysis previously made. So, in some ways, it may be compared with a matrix in which one cell represents the task of a participant (row) for a service delivery stage (column). At this point, the firm should decide what will be the offering of each channel. Providing every offering in all the available interfaces would not be efficient, due to the wrong resources allocation, and probably it would not answer to the customer requirements (Patrício et al. 2011)

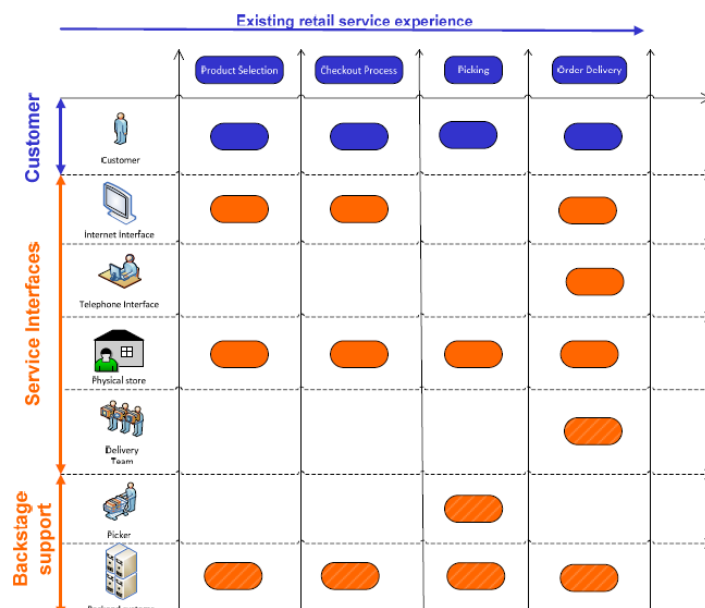


Figure 11. Service System Architecture for a retailing service (Patrício et al. 2011)

While the SSA presents all possible interactions and tasks, the SSN (Figure 12) provides a more dynamic view of the service system (Patrício et al. 2011). It can be compared to the process mapping in BPM since it represents all the possible paths from beginning to end. Different customers will search for different interfaces and accomplish different experiences. Each path can be associated with a customer journey crossing all touchpoints. Analyzing the SSN allows understanding how to design a service encounter in order to enhance the customer experience. (Patrício et al. 2011).

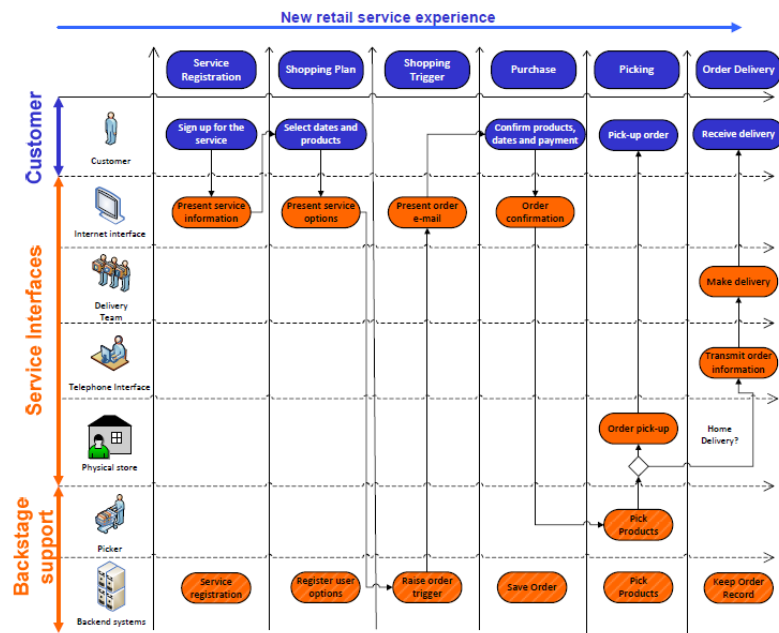
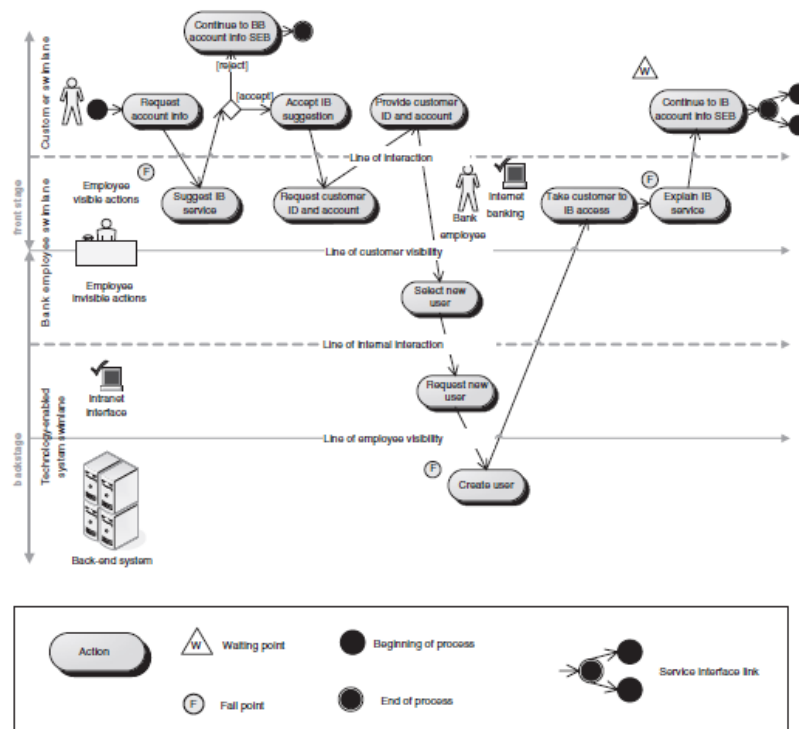


Figure 12. Service System Navigation for a retailing service (Patrício et al. 2011)

For each phase in the service system, it is possible to detail the activities performed. As from a process map it is possible to model each activity into detailed tasks. The same rationale can be applied to designing the service encounters based on the service system. The MSD uses the SEB method to map the service encounters. The SEB maps the interactions with the service provider for a given interface (Figure 13), including the representation of the waiting and failing points. It has the same layers as the SSA and SSN, divided by the lines of interaction and visibility (Patrício, Fisk, and Falcão e Cunha 2008).

The SEB method brings together Requirements Engineering, Process Modeling and Service Design methods. It takes into consideration customer requirements for each interface and touchpoint through a Goal Oriented Analysis (GOA) and uses those results to represent a swimlane based artifact with different actors mapping tasks using Business Process Model Notation (BPMN). But it also has some additional elements such as the interface link that suggests the linkage with another interface, i.e., the continuation of the process in another service encounter. This may contribute to an efficient design of the service delivery flow with smooth transitions in interfaces without decreasing the service level (Patrício, Fisk, and Falcão e Cunha 2008)





NOTE: BB = branch banking; IB = Internet banking; SEB = Service Experience Blueprint.

**Figure 13. Service Experience Blueprint for a Banking Service Encounter (Patrício, Fisk, and Falcão e Cunha 2008)**

The MSD method is very complete considering that it responds to the customer experience design paradigm and enables the utilization of several interfaces, physical or digital. In the digital era, the increase of electronic services or e-services creates the challenge of offering different interactions through the same channel (in this case, internet). Therefore, it is important to understand what type of encounter will occur. The amount of service intervention, the level of user participation are two of the possible variables to define whether the encounter can be classified as informational, self-directive, intervenient or intensive (Cho and Menor 2010). This classification is dependent on the customers' independency in the co-creation of the service and on the amount of intervention of the service provider (Table 8). The resulting service customization will also vary accordingly to the level of each participant intervention. The most customized encounter is the intensive since it requires more intervention from both sides. It can be seen as a merger of self-directive and intervenient encounters (Cho and Menor 2010).

Understanding what type of service will be provided may help in the resulting service quality and consequently increase customer satisfaction.

**Table 8. Types of e-service encounters and characteristics**

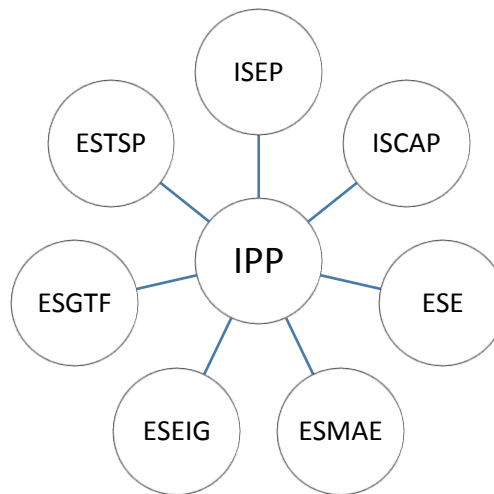
<b>Type of encounter</b>	<b>Informational</b>	<b>Self-directive</b>	<b>Intervient</b>	<b>Intensive</b>
<b>Level of user intervention</b>	Low	High	Low	High
<b>Level of service intervention</b>	High	Low	High	High
<b>Level of customization</b>	Low	Low	Medium	High
<b>User Objective</b>	Acquire information	Provide information	Acquire real-time information	Exchange information
<b>Main responsible for success</b>	Service provider	User	Service provider or user as provider	Service Provider and User

### 3 Porto's Polytechnic Institute

#### 3.1 History

Porto's Polytechnic Institute was created in 1985. Its goal was to integrate several Higher Education Schools and Institutions as the Polytechnic Education gained a new importance in the Portuguese context at the time.

In the beginning it was composed by the schools of Education (ESE) and Music, later renamed Music and Performing Arts (ESMAE). In 1988, the Engineering Institute (ISEP) was added and, in 1989, the Accounting and Administration Institute (ISCAP). Until 2004 it would also include Management and Industrial Studies School in Vila do Conde (ESEIG), Management and Technology School in Felgueiras (ESTGF) and Health Technologies School (ESTSP), Figure 14, thus offering a wide variety of courses and in several cities, contributing to the development of education and economy (Instituto Politécnico do Porto 2014).



**Figure 14. Porto's Polytechnic Institute schools.**

Along the years, the strategy was to create graduate courses that met the local market needs and, focusing on preparing students with practical tools for the labor market while local Universities focused more on endow the students with the theoretical tools. During the 1990's the demand for these courses grew and the Portuguese market went through several changes, leading the Institute to change according to it. In fact, the two largest schools, ISEP and ISCAP, became competitors for the similar courses in the University. Today, with the adaptation to The Bologna Program, most of the courses are prepared to be included in the European Higher Education Area.

##### 3.1.1 ISCAP

The school that served as a case for this research was ISCAP, the second largest school from IPP and the first one to implement the IS.

The school became part of IPP only in 1989, but its history begins in 1886 with the creation of the Commercial and Industrial Institute. Only in the 20<sup>th</sup> century the industrial and commercial areas were separated in to different Institutes, Commercial Institute and Industrial Institute. The

first one would later become ISCAP, a technical school that offered education for management support jobs. The latter originated the Engineering Institute, offering technical degrees in the engineering area.

The courses offered by this HEI were always adapted to the current needs. Currently, there are five 3-year undergraduate courses (licenciatura) available; the most important one being Accounting and Administration, Marketing and the most recent Tourism Activities Management course.

With the renewed courses under the Bologna Program, the school added some Master programs to its curricula. Consequently it is gaining more applicants and its strategy in positioning itself in the Higher Education market has been restructured for the last ten years, as it will be described in the next section.

### 3.2 Current Strategy

The evolution in the Portuguese Higher Education system also imposed a new strategy in the communication and relationship with students. In ISCAP, the adoption of Bologna Program led to restructured courses and classes. The school started to use ECTS, evaluation methods changed and students' schedules are now based on 90 minute classes, with ideally 30 students per class group.

During this process, the Quality Manual was created, in which it is possible to find the organizational structure of ISCAP with its management councils and administrative support services (Figure 15, appendix B). The organization is still very centralized in the board of direction, though there are three other management boards, all their actions depend on the President's approval. For the organization, this is seen as an advantage, even though it has associated the disadvantage of creating more complex processes and more bureaucracy (Pereira, Azevedo, and Castilho 2007).

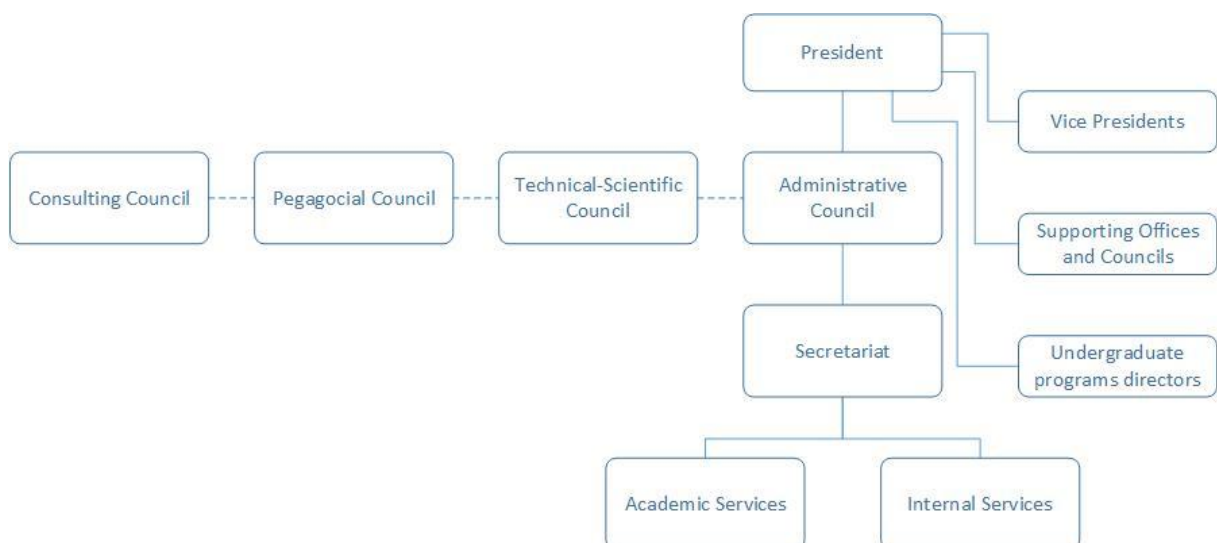


Figure 15. ISCAP's simplified organization chart.

Besides the management councils there are approximately 25 support administrative services, such as Informatics Centre, Library, Human Resources Management Division and Internships Division. All these services are composed by small teams, some with very well defined responsibilities and others that are interdependent, and accumulate several activities, for instance, the Teachers' Support Division.

The recent changes in the HE system brought new challenges for the administrative services, and IS have had an important role in the entire process. While maintaining the same number of employees, HEI have to respond to an increased workload. Also, with new technology, internal communication is constantly changing. This is in agreement with the paradigm of increased level service demanded from customers, related to the amount of information required and to the time they are willing to wait.

The Bologna Program led, not only to the internal reorganization, but also to the restructuring of the courses. For each program, ISCAP renewed the syllabus focusing on current market needs. With a diversified offer in management support degrees, ISCAP has been able to attract more students. All programs take in account the technical focus that guide IPP's strategy.

Throughout this change process, HE started to be seen as a market competing to get students' attention who started to be understood as customers of a service, leading to the adoption of the concept of Student Relationship Management, SRM (Lechtchinskaia, Friedrich, and Breitner 2012). HEI began to offer all kinds of services. Amongst them were internships and recruitment, workshops in soft skills, and others that intend to prepare the student for the labor market. This is in alignment with the idea of the student as a customer since these services appeared to retain students and improve his/her relationship with the institution. The consequence of this was the fact that students as customers claim their rights and seek quality not only in teaching but in the support services.

In order to improve service and implement the SRM concept and strategy the school started and IT project that will be described in section 3.3.

### **3.3 Information System**

Facing the same problem as many HEI, in 1997 ISCAP began a project that intended to develop computer tools to help in the administrative services. The IS planned to support academic management and to improve student relationship.

The current system seeks to take advantage of SRM, ERP and Business Intelligence (BI) features. The SRM is mainly characterized by the continuous contact with the student, providing information and help to all students. It also allows alumni to interact with the school and offers a customized service for every user. Mainly it is designed to promote and facilitate the communication and collaborative work (Pereira and Castro 2012). The approach in this case is to consider the student as a client. A well-built SRM may be used in marketing strategies when acquiring new students and retaining current ones. This is the goal of ISCAP's SRM, to be able to attract new students by communicating with potential students and retain former students when they are looking to improve their education (Pereira and Castro 2012). One of features of the system is the existence of different communication channel. The main one is the web interface through the institutional website and the Online Secretary (SO), which will be briefly described after; the SMS (Short Message Service) that decreases the accesses to the SO since students may receive notifications via mobile phone; and the telephone CTI (Computer Telephony Integration) (Pereira, Azevedo, and Castilho 2007)

By using the Moodle platform for PAOL (Projeto de Apoio Online – Online Support Project) the school was able to draw nearer the students by providing them tools conditions for a personalized learning process. This was done by offering online contents for all courses. PAOL started in 2003 and grew enough to become an independent office. Currently named GAIE (Gabinete de Apoio à Inovação em Educação - Innovation for Education Support Office), it offers training in online tools in education, such as online evaluation, social networks and videoconferences (Pereira 2011).

At the same time, there is the support delivered by the ERP with the online and desktop applications that enable the information management and decision-making by the management councils (Pereira, Azevedo, and Castilho 2007).

Another project developed in the last decade was the creation of Online Secretary (Secretaria Online – SO) that intended to turn the SRM platform in an interface where students could do what they usually do at the physical secretary interacting with an employee. The main objectives (Table 9) were to decrease waiting time in lines by fastening the insertion of information during the busiest periods of the year (Pereira 2011).

**Table 9 Main goals of the SO (Pereira 2011)**

<b>1</b>	Decrease waiting time at helpdesk.
<b>2</b>	Decrease the number of students served locally.
<b>3</b>	Facilitate the communication between school and student.
<b>4</b>	Reduce the waiting time for requested documents.
<b>5</b>	Achieve better performance during critical periods of activity.
<b>6</b>	Facilitate the reception of large amounts of information.
<b>7</b>	Keep record of all academic data with quality.
<b>8</b>	Minimize information errors.
<b>9</b>	Detect and correct errors that may create irregularities in students' situation.
<b>10</b>	Improve working conditions for employees.
<b>11</b>	Reduce extra working hours.
<b>12</b>	Share information between all school departments.

Currently, it is hard to distinguish between the SRM and ERP functionalities since most of them are available on the SO. In fact, one of the goals is to make all services from the ERP available online. This integration of ERP and SRM has been happening by the progressive implementation of the different desktop applications in the SO. This process generated the existence of different user profile levels, thus minimizing the impact of the back office and front office interaction (Pereira and Castro 2012). The integration lead to the difficulty of setting boundaries between the two systems, since they coexist and depend on each other even though they are two different systems with different characteristics and goals (Pereira 2011).

A practical example of the integration is that the applications that compose the current ERP (Table 10) get information from the SRM database, except from the financial module that has its own database (Figure 16), and the Students Management System that also has its own and uses information from the SRM as well (Pereira 2011, Pereira and Castro 2012). The fact that there is one main database to store students' information helps eliminating the department isolation that was common in the previous management strategy (Pereira 2011).

**Table 10. List of Applications that compose the ERP base.**

Name		Characteristics
<b>SGA</b>	Students Management System	Gather and manage students personal information for academic services Oracle forms
<b>SGH</b>	Schedule/timetable Management System	Manage course scheduling according to certain criteria Web environment
<b>SGV</b>	Surveillances Management System	Manage professor allocation in exam surveillances and exam dates Web environment
<b>SGRH</b>	Human Resources Management System	Manage employee related information Web environment
<b>SGCP</b>	Attendance Control Management System	Manage and control professors attendance by fingerprint readers installed in each classroom
<b>GIAF</b>	Administrative and Financial Integrated Management	Financial ERP Module (acquired)
<b>SIIC</b>	Copy and Print Integrated System	Manage network printers and personal account credit
<b>SGCA</b>	Accesses Control Management System	Control local accesses of people and vehicles and other security related issues

Today, the evolution of the service level in the last 14 years is visible even if there are some aspects to improve. With the evolution of technology, the team behind the project is always seeking new ways to improve the service offer and implement more and innovative functionalities. When compared to the past, there are no waiting lines for classes or exams registration; there is no time between the professor sending the grades and the students receiving them because there is no need to go through the staff to manually insert it. A teacher can even digitally sign documents after releasing grades. The e-learning project (PAOL) offers the possibility of creating b-learning courses where the students have some classroom sessions but most contents are available online, and even the evaluation can be done using Moodle functionalities. The available services make the main academic activities available online (appendix C).

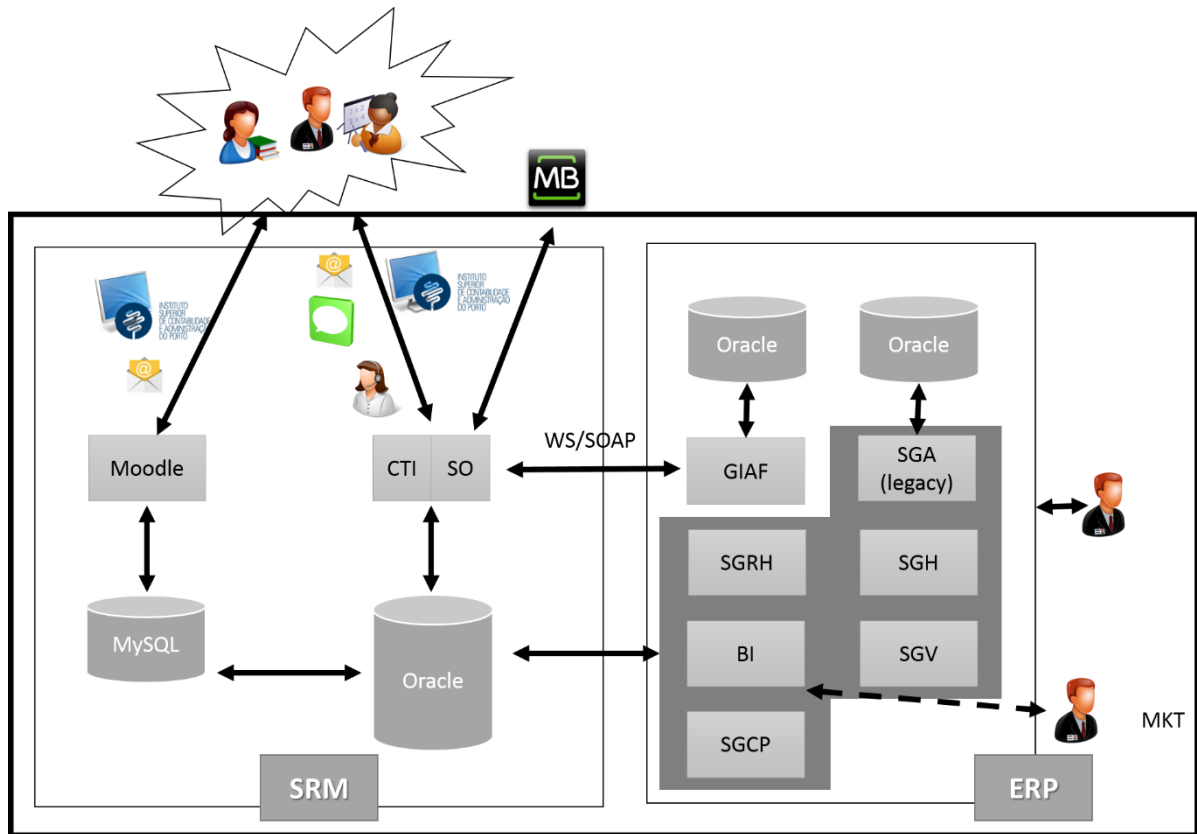


Figure 16. Applications Architecture and Databases (Pereira and Castro 2012).

Currently there are four different channels to interact with students: web, e-mail, telephone and SMS (Figure 17). The web interface can be separated in the institutional website, for public usage and information, and the online secretary, for managing students' information and academic tasks (Pereira 2011).

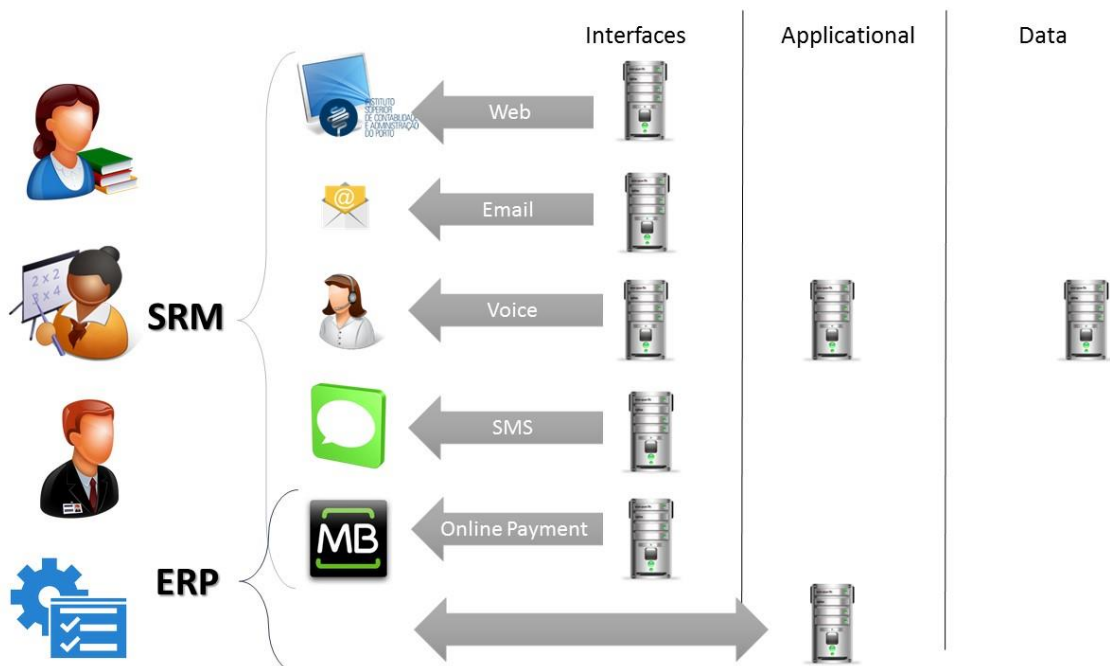


Figure 17. Possible interactions with SO (Pereira 2011).



In sum, it is possible to distinguish three stages of the project. The first one, starting in 1997, aimed to help daily tasks by computerizing most of them through the ERP implementation (Pereira 2011). This was supposed to reduce time for each task and manage all the information associated with students and their academic journey. By 1999, the second stage began, with the objective to bring the school closer to the students, creating the SRM system (Pereira 2011). The approach, can be compared with a service company if professors are considered partners of the main service provider and students as the final customer. This perspective helps to understand the actions that the system needed to support since professors and students are both origins and destinations of information, managed by the service provider, ISCAP. The SRM (Online Secretary) was used to produce information that was then managed by the SGA (Pereira 2011). Another form of understanding is considering SGA as the computerized secretary and the SO as the online service to communicate with the secretary. Finally, by 2003, the third stage began with the first steps in the e-learning project that was developed to improve students' retention and decrease school dropouts (Pereira 2011).



#### 4 Methodology

This section presents the followed methodology during this project (appendix D), which consists on the following phases:

- Theoretical Research;
- Data collection;
- Data analysis;
- Business Process Reengineering Proposal;
- Conclusion.

In this research, the methodology regarding the business reengineering proposal merges BPR practices with the EAD framework and MSD method. Considering that the Zachman framework is used in EA projects where processes and information systems are created or re-defined, this project integrates the MSD method in the Zachman Framework. Thus suggesting how the customer experience issues can be managed together with the internal issues. In sum, instead of considering internal constrains as a BPR project, or the customer perception and needs as a Service Design project, it considers both. Hopefully, the reengineering of processes will satisfy administrative councils, employees and customers. It is possible to establish a parallel between an EA and a SD project and take advantages from the two, adapting the phases and complementing both methods (Table 11).

**Table 11. Project methodology and equivalent phases from MSD and EAD**

<b>Merged approach</b>	<b>MSD</b>	<b>EAD</b>
1. Planning	Mission, vision, goals	Initiation
	Stakeholders	Strategic – Operational Summary
2. Current Situation	Current Service System	Business Architecture
	Current Service Encounter	Current Systems and Technologies
3. Customer service perception/Customer needs	Customer Experience Requirements	-
4. Business Process Redesign	-	Business Process Redesign
5. Situation to be implemented	New Service System	-
	New Service Encounter	-

Data collection had the purpose of characterizing the school's current situation. This phase can be divided in three sub-phases, even if they occurred in parallel. The project gathers information from internal processes, information system and from the service provided to the students. The information was obtained through meetings, interviews, study the school documentation and online survey to students and teachers.

The documentation provided was related to internal aspects of the school organization. The Quality Manual (ISCAP 2012) was the main source of information to understand the organic structure and internal regulations, while the Processes Manual for the Academic Area (ISCAP and Indeve 2009) provided information about main processes related with student's interaction with the physical secretariat.

The IS description done in section 3.3 was based in articles and other work from the team responsible for the system development and implementation. To have a deeper understanding of the interactions between the system's applications and databases, there were three meetings in order to see a demonstration of some system functionalities.

As for students and teachers, their participation was essentially by an online survey (appendices E and F). This tool was chosen due to the fact that questionnaires are one of the simple ways to get large amount of information. Rather than understanding customers' needs, the intention was to understand customers' perception of the service usefulness. If a function has a low rating, users might not know it well or it might be an indicator of improvement. To have more concrete information, another questionnaire or focus groups could be realized. However, due to participants scheduling difficulties, informal interviews were made. These interviews helped to distinguish between the front office and the back office issues, while questionnaire responses do not assure if the respondent is considering one, the other or both. As an attempt to increase the value of the collected responses, questions addressed both physical and digital services as well as interactions and non-visible actions.

The results of the questionnaires, together with processes analysis were the source of the decision about what should be the focus of the project. If a process had too many participants it would not be possible to include them all in time to have enough information; if a process depends on the management councils of the school, it would not also be possible due to difficulties in involving them in the project.

After selecting the process to redesign the phases 1, 2 and 3 from Table 11 are considered completed. Then, all the information collected was used as constraints to the redefinition of the process. An example is the fact that the phases Data Architecture, Application Architecture and Technology Architecture were not performed. One constraint was that the mentioned architectures should be kept the same due to funding limitations. The process should use existent functionalities and adapt them to serve new purposes.

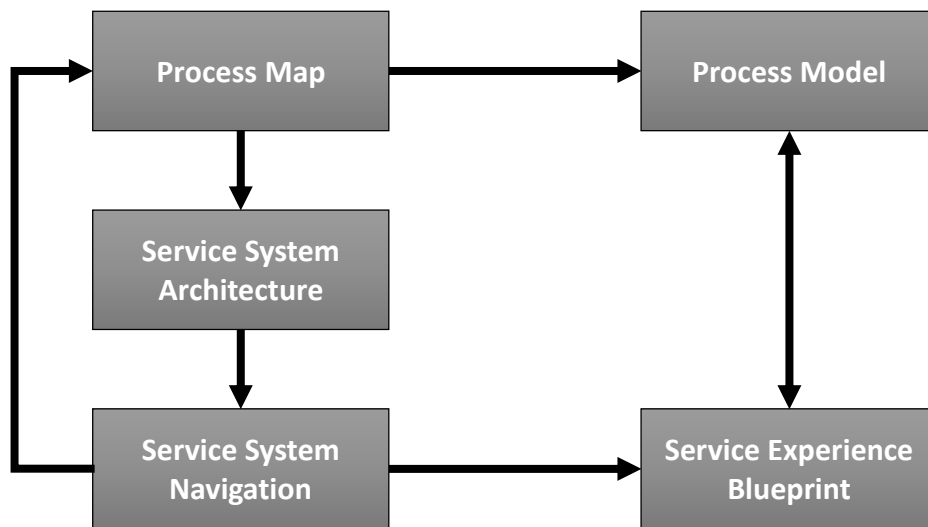
When analyzing a SD project, this reengineering is not included as an independent phase, but it is implicit in the Service System proposal. The difference in this project is that the new process was used to redefine the internal workflow and, after, the service system design was used to understand if the new process satisfied the customer requirements.

So as to achieve the best combination of process reengineering and technology usage, teachers responsible for the process and technicians from the implementation team presented their concerns and constraints. The process was defined considering a possible amount of innovation, yet keeping a similar workflow, so it is accepted by all participants.

The potential from the existent technology was the advantage. Once there are many processes triggered by students' actions online, it was possible to use the same rationale in the new process. At the same time, the usage of online functionalities could be well accepted by the teachers involved in the process.

After redefining the process to satisfy the internal participants, the project methodology suggests the usage of MSD method. This method helps understanding the customer perspective. Mapping all the student's actions is useful to evaluate if the desired internal process also satisfies the student's requirements.

For the adaptation from the BPR and the MSD, the SSA was based on the process map. Then, the SSN supported the verification of the workflow and touchpoints. SSN showed some advantage when analyzing possible interfaces and possible actors in the process. Finally designing the SEB enabled the mapping of the waiting and failing points. When used together, SEB and process modelling, allow the execution of an iterative process based on tradeoffs in which internal efficiency and customer experience are the variables (Figure 18).



**Figure 18. Framework based on artifacts from BPR and MSD.**

The integration of the MSD in the Zachman Framework is justified by the fact that MSD artifacts answer the same of the questions presented by Zachman. It is even possible to include other aspects usually studied in SD projects such as interface channels, determined with customers' insights, and physical evidence. So, the CVC, SSA, SSN, SEB, channels and physical evidence can be integrated in some cells of the Zachman Framework matrix considering the customer as a participant the of the project in the conceptual level (Table 12).

**Table 12. MSD integration in Zachman Framework**

Zachman Framework Cell				Zachman Framework	MSD integration
Perspective	Focus	Player	Question		
Contextual	Data	Planner	<b>What</b>	List of things important to the business	CVC
Contextual	Function	Planner	<b>How</b>	Process Map	SSN
Conceptual	Function	Owner	<b>How</b>	Process model	SEB
Contextual	Network	Planner	<b>Where</b>	Locations	Channels
Contextual	People	Planner	<b>Who</b>	Responsibility definition	SSA
Logic	People	Designer	<b>Who</b>	Human Interface Architecture	Physical Evidence

The relations presented can be understood if the customer is considered an active participant in the definition of the Service Concept (MSD 1<sup>st</sup> level). By knowing the customer needs the planner of the project will be able to design the CVC, defining “What” will be offered. When designing the Service System (MSD 2<sup>nd</sup> level), the planner will define the main activities to be considered, its participants and the channels through which the customer will execute them. Thus, answering to the “Who” and “Where” at the contextual level. The artifacts related to this parallel will be the SSA from MSD and the Responsibility Matrix from BPM. As mentioned before, the SSN can be related to the process map. Therefore its association with the “How” at the contextual level. Once the SEB (at the Service Experience Design – MSD 3<sup>rd</sup> level) adds more detail about the customer’s interactions with the service it can be associated with the process model, answering to the question “How” at the conceptual level. In fact, at the conceptual level the SEB can be associated with the Function, Network and People foci, because it helps managing the touchpoints, defining who interacts in which channel and how that interaction occurs. If the SEB is integrated in the business management perspective, the physical evidence is related to the designer perspective, since it is used to define the interface for each channel. Therefore its integration with People focus. The Zachman Framework presents the Human Interface Architecture, but in services, interfaces can be digital. Nevertheless, they represent what the customer sees from the company.

In this project, it is presented the business process model, the SSA and the SSN of the selected process and after some blueprints were designed as to help the visualization of some possible failing points from the process definition. The models and diagrams were designed with using *Microsoft Visio*, *Bizagi Process Modeler* and illustrating icons from *iconfinder.com*.

## 5 Data Analysis

Before deciding what was the best way to improve the service perception from the student's perspective it was important to understand the current perception. The online survey had the objectives of retrieving information about the IS utilization and finding which were the possible services that could be improved. Some of the questions addressed the issue of backend workflow. Although this is not visible to the students, it was important to know how it affects the service quality perception. More information about this was collected in the interviews (appendix G) where several students showed more concerns about organization and people than the IS itself.

As explained in section 4, other inputs for the project were the current situation of business processes and the current functionalities and capabilities of the IS. The IS served only as a reference to what could be implemented. First, because it was important to implement something similar to what users are already familiar with, and second, because the implementation is much easier and faster since it is only adapting an existing functionality. The current processes models were an important source of information, since it was not necessary to interrupt employees and observe their work.

This section presents the results from the gathered information divided in three parts: business processes models, questionnaire results and IS. The current information system is already presented in section 3, however section 5.3 will present some more details related to this project.

### 5.1 Business Process Models

Business process modeling in ISCAP is a responsibility from the quality department (GAMC). The processes from the academic area are the ones currently documented. This was enough for the moment once the goal was to study processes in which students are involved. A possible sequence of events in the student relationship with the school during the semester was outlined (Figure 19). Those were considered the high level processes, and as it will be explained after, the survey addressed those moments in the students' interaction with the IS.

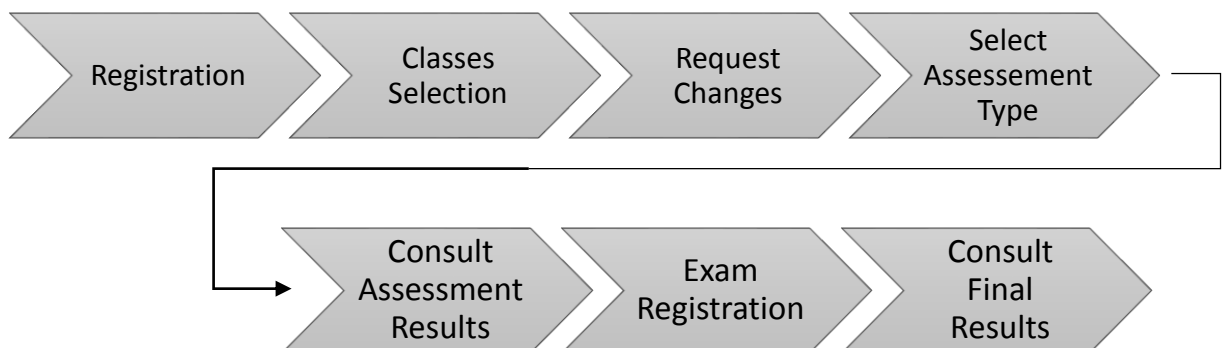


Figure 19. A student journey throughout a semester

Activities such as scheduling classes, allocating students to classes, assigning teachers to classes are the most complex. From the observation in the beginning of the second semester these were found to be critical moments in the workflow and internal communication. Students want to get information as soon as possible, but due to the lack of human resources, sometimes schedules were redefined to have a number of classes according to the number of available professors. This could be made by creating a decision support system associated with the school's ERP. However, due to the available time of most of the stakeholders for redefining those processes it was not possible to study them in this research.

At the same time, exploring the SRM allowed to realize which processes had less IT support. Processes like consulting grades, that only provides information to the student, were quite simple to use; other processes are implemented for a long time and, even though some improvement is possible, it would imply changing the schools' regulations. Since this was not possible, requests and helpdesk were the processes that showed more potential to be addressed in this research.

## **5.2 Questionnaire Results**

So as to involve not only the customer but also the service provider partner, two questionnaires were performed. In this case, the customer is the student, and the service provider facilitators are the teachers that participate in the process. Teachers are service provider facilitators as their main responsibility is not the students' management but still the service depends on their participation. Nevertheless, they are also users, so it is helpful to consider them a different group of stakeholders from the employees.

The questionnaires were available for two weeks in the SRM's profile page of each student and teacher. A total of 3850 students and 217 teachers had access to them. In the end, there were 723 responses from students and 108 from professors, lecturers and tutors.

There are three different parts in the surveys. The first is about general information to allow the characterization of the sample, the second addresses the services available in a way that enables understanding which are the most used and how users interact with them. The last part is related to the user experience with the IS.

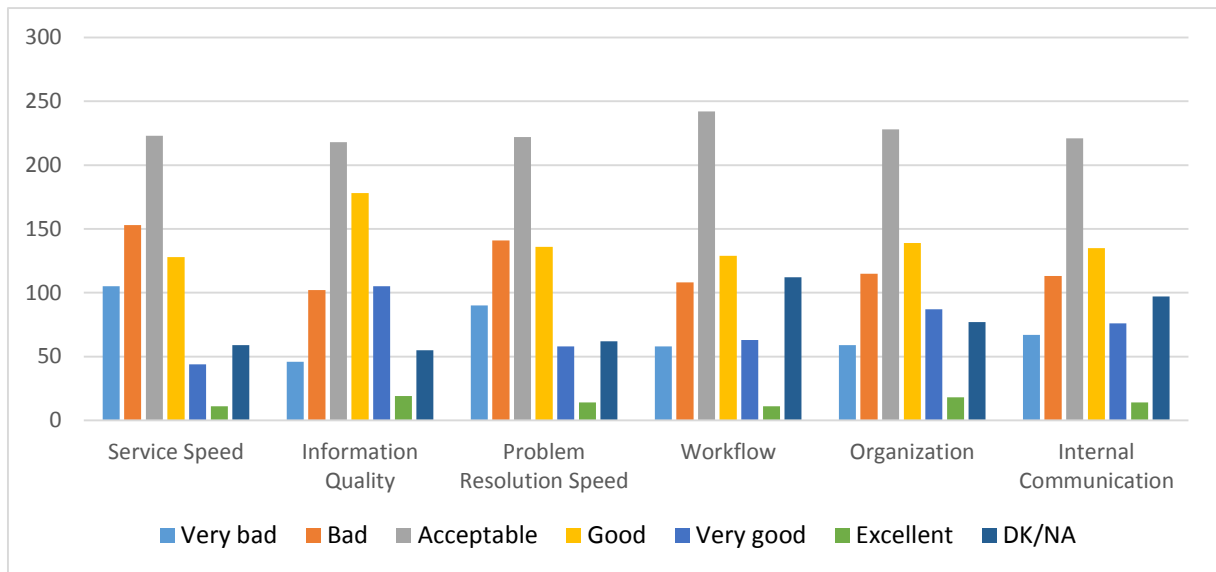
### **5.2.1 Students Questionnaire**

The 723 responses represent 18.8% of the student's community. A short analysis is here presented. The detailed information of each question is found in the appendix H. From the participants, 65% are between 18 to 25 years old. Freshmen and seniors were the major respondents in the survey. Between seniors, there was the same proportion of responses among second and third year students. As expected the majority of the daily students are currently just dedicated to the course (345 out of 406 – 85%) and the after-work students also have jobs (206 out of 317 – 65%).

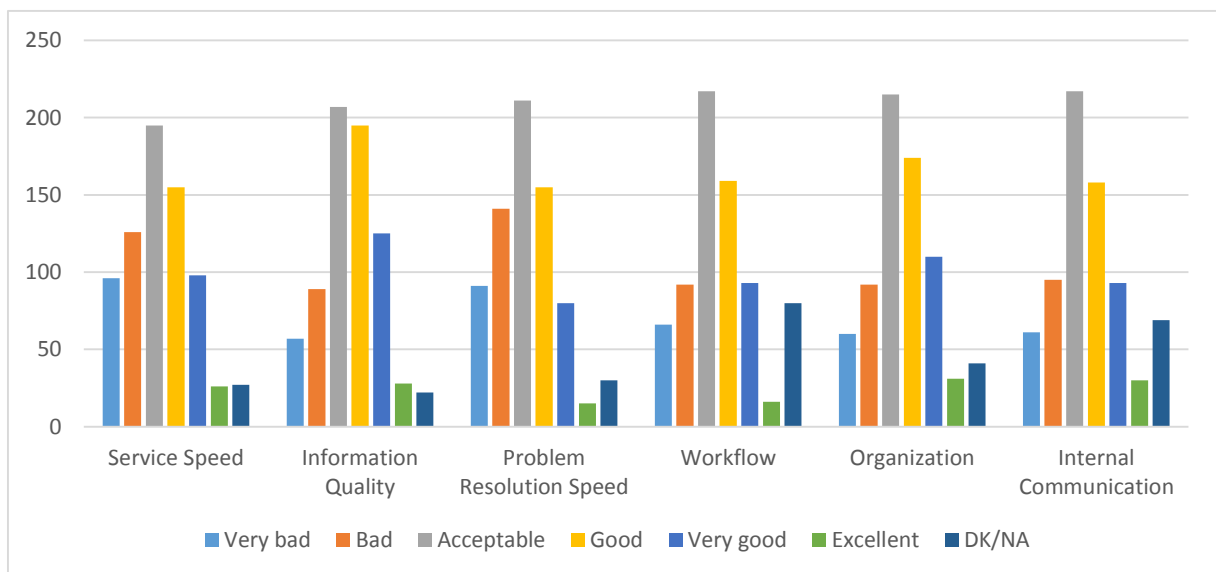
When asked about the type of interaction with the academic services, 688 from the 723 state that they use the online services, even if they sometimes use other services. This result supports the decision of this project about improving processes that have technological support and in which the students participate actively.



As mentioned in section 4, there was the intention of distinguishing the academic physical services from the digital services, and the back stage from the front stage issues. So, the students were asked to rate their experience with the physical and the digital services for six different criteria: service speed, information quality, problem resolution speed, workflow, organization and internal communication (Figure 20, Figure 21). The range of rating was from 1 to 6, namely, very bad, bad, acceptable, good, very good and excellent. The choice of an even number in the Likert-type scale had the intention of forcing respondents to have an opinion (Garland 1991). However, since there are some services that respondents do not use the *Don't Know* choice was still offered.



**Figure 20. Physical services evaluation criteria**



**Figure 21. Online services evaluation criteria.**

The graphics in the figures represent the number of responses for each criteria and show some interesting results. Observing only DK/NA answers, the “workflow” criterion is the one with more responses of that type. This may lead to the conclusion that students don’t know what

happens in the backstage. From a service perspective, ideally, the activities in the back office should be reflected in the front office. Despite the higher number of DK/NA answers, this criterion shows an increase of high rating from the physical to the digital services. For the level 4 (Good) the digital services got more 30 answers. For the level 5 (Very Good) an increase of 30 answers is also verified. Representing 23.3% and 47.6% respectively. The results may be related to a dual interpretation of the question. Some students can realize that they have no perception about what happens when they are not interacting, and other students can conclude about the workflow based on the visible results of the processes. Thus, an adequate workflow may cause a pleasant service experience even if there are no visible actions for the customer.

When analyzing the weighted mean rating for each (Table 13), the information is not enough to distinguish any of the criteria since they are all close to 3. The highest is 3.4 and the lowest is 2.8. The perception from the students' perspective is that online services are better in all aspects.

**Table 13. Average Ratings for Physical and Online Services, students' results.**

Criteria	Mean Rating		Difference between means
	Experience with Physical Services	Experience with Online Services	
<b>Fast service</b>	2,83	3,16	0,33
<b>Information Quality</b>	3,38	3,47	0,09
<b>Fast problem resolution</b>	2,96	3,05	0,09
<b>Workflow</b>	3,10	3,26	0,16
<b>Organization</b>	3,21	3,40	0,20
<b>Internal Communication</b>	3,13	3,33	0,20
<b>Mean (M)</b>			0,18

To support that conclusion a hypothesis test was performed to the difference of means (David M. Lane 2014). Once the questions approach the customer experience in different interfaces, it suggests that for a single customer one is better than the other. A linear regression with a  $r$  factor of 0,889 confirms the relation between the two. The next step was to perform a single mean test to the difference of the means (Table 13). The null hypothesis considered was the difference of means being zero ( $\mu=0$ ). So, in order to support the aforementioned conclusion, the test must reject that hypothesis and accept that the mean of online services experience is higher than the one of physical services. A correlated  $t$ -test was used to compute the probability of this hypothesis. Using the values of  $M$ ,  $\mu$  and the estimated standard error of the mean  $s_M$ , the value of  $t$  for the significance test was determined. With a standard deviation  $s$  of 0,089 and a sample size  $N$  of 6,  $s_M$  value is 0,036. Therefore  $t$  is 4,95 and the resulting probability of a two-tailed test is 0,00426 considering  $N-1$  levels of freedom ( $N=6$ ). This results supports the rejection of the null hypothesis and the acceptance of the hypothesis that the mean of online services experience is higher than the mean of physical services experience.

Related to the frequency of functionalities usage (appendix H), as it was expected, the ones that are exclusively performed online are the most used (Fees and Payments, Assessment Type, Exams Registration) and the occasional ones are less used (SMS, Printing services).

One important observation at this point is the fact that Helpdesk is not very used. Probably meaning that students don't feel the need to ask for help. On the other hand, during the interviews it was possible to conclude that many students didn't knew about the existence of the service. As for the requests, that was one of the processes studied, there were 373 students out of the 723 respondents (51.6%) that have used the online service to insert a Request. Though, when asked about the satisfaction with the service the Schedule changes, the Helpdesk, the Status Request and Requests are considered the worst (Table 14). The conclusion that these are bad services is wrong. Instead, what might be said is that the students' perception about these is not as good as the others.

**Table 14. System Functionalities Average Ratings.**

<b>System Functionality</b>	<b>Average Rating</b>
First Registration - login attribution	3,82
First Registration - classes selection	3,84
Registration renewal - classes selection	3,84
Schedule changes	3,17
Requests	3,27
Status requests	3,25
Helpdesk	3,20
Printing Services	3,38
SMS	3,37
Exams registration	4,13
Assessment Type	3,98
Contact with teachers	3,47
Messaging	3,45
Fees and other payments	4,29

As for the need of the functionalities, 75% say that the current system responds to some or many needs and 10% participated more actively and gave ideas to new functionalities. The most suggested was the existence of an online real-time chat to communicate with professors instead of scheduling time at the office.

A contradictory result was related to the origin of flaws. In the survey they are associated with the system failures but in the interviews students mentioned more issues of organization. This can be related to the fact that students associate system failures to the wireless connection failure or to the server capacity, as mentioned by some in the interviews.

So far, the results support the choice of improving helpdesk or requests processes mentioned in section 5.1. Despite the evaluation not being negative, the fact that they are not very used and have the lowest ratings may indicate that an improvement in this area could bring more students to use it with a better level of satisfaction.

### 5.2.2 Teachers Questionnaire

The participation from professors represents 49.5% from all the active professors at the moment of the survey (108 out of 217). The detailed information is found in the appendix I. From the respondents, 63 are female and 45 are male. Half of the respondents is between 41 to 50 years old (50%), only 21.3% are under and 28.7% are over 50. Relatively to their professional status, the majority are exclusively working full-time at ISCAP and around one third is a professor there for over 20 years, and another third between 10 and 15 years. The respondents are mostly professors without any management responsibilities, though their opinion can be associated with a customer as they are helped by the employees in serving the students so their activities depend on the service provider. There were 13 answers from professors with some type of management task.

When asked about the schools' structure and the offices 97% affirm that they know it, but only 5 of the 23 offices are used by more than 50%. The most used is the Informatics Support Office. What would be expected was the Helpdesk system reduced the number of physical requests at this office. The same happens with the interaction with the academic services. Despite having email and telephone, more than 80% prefer personal contact with the Human Resources (HR) and with the Teacher Support Office.

Related to the service rating, the question was the same for professors and students. Although the average rating is higher ( $\approx 4.5$ ) for all the services, there is an unexpected result. Professors have a better experience with the physical services than the online services (Table 15).

**Table 15. Average Ratings for Physical and Online Services, professors' results.**

Criteria	Average Rating	
	Experience with Physical Services	Experience with Online Services
<b>Fast service</b>	4,73	4,60
<b>Information Quality</b>	4,80	4,60
<b>Fast problem resolution</b>	4,60	4,32
<b>Workflow</b>	4,44	4,39
<b>Organization</b>	4,48	4,33
<b>Internal Communication</b>	4,37	4,26

Even if the results show good experiences with the services for all criteria, the criteria with lower ratings are: workflow, organization and internal communication. Again, this shows the potential of improving processes. As the students' results showed, this does not mean the services are poorly organized but that they can be better. In fact, in some interviews it was clear the school's will to improve whenever and wherever possible.

The questions related to the type of utilization were different from the students' questionnaire, once the activities are specific for their function in the school. The results are consistent with

what was mentioned so far. Professors use the system functionalities that can be performed exclusively online, but when there is the possibility of personal contact they choose it over online interaction. According to the results, the functionalities are enough for their daily activities, given that more than 80% use the system almost every day and say that the system responds to most of their needs.

Finally, the last question was related to the origin of flaws, which in this case were mostly associated with the system. In spite of the system being in use for several years, professors that were used to non-digital processes may still be adapting to new technologies and are reluctant to be completely dependent on the IS.

Discussing whether the system access is facilitated through personal computers and mobile devices would be out of the context of this project. Then, the conclusion from this survey was that some organization improvement is needed and when the system is compatible with the processes people adhere to it, as in the success case of grading and summary registration.

### **5.3 Information System support to *Request Process***

Section 3.2 presents the global system that supports all management activities and interaction with students. The SGA and the SO are ISCAP's ERP and SRM system. In the last few years the strategy has been to integrate the two reaching a point that the separation is no longer visible in daily operations. These two systems will be here considered as one with frontend (SO) and backend (SGA) support.

Considering the questionnaire results and the information obtained from processes documentation, the project will focus the processes involving requests and consequently involving students, school services and professors. As already explained, there are different types of requests. Students may request documentation (diplomas, registration certificate, etc), may request students' status (athlete, working-student, etc) and may also use the helpdesk. These request are supported by a workflow system that may be flexible or not, depending on the type of request.

This workflow is not supporting the process of Competences Certification by which a student requests the analysis of his/her curriculum so to have equivalences to previous classes in other college or even the certificate of a diploma based on working experience or equivalence to a foreigner graduate course. This is possible due to the ECTS system used with Bologna Program.

The only technological support that this process has is the creation of the final document. A desktop application uses the SGA database to access students' information. In the case of an internal course change, it suggests equivalences. In the case of external students the committee needs access to the students' previous course program. Based on the workflow existent to similar processes and the characteristics of this process, this was the process chosen to be redesigned in order to have more technological support. According to the process documentation this process can be improved with the implementation of the workflow, and this is supported by the students' results, in which, requests seem to be a functionality with higher probability of acceptance.

To support this decision, it was conducted an interview with a member of the Competences Certification Committee, an IS support engineer and the employee responsible for creating the

final document. This interview confirmed that most of the process is manual with paper support. The process only uses the system to register the request and the final decision.

At this point, there are main advantages from implementing a workflow process. According to students interviews, the secretary opening hours do not match working students schedules. Therefore, the possibility of performing tasks online is very attractive. Besides, once professors can do the work without being in the committee's office, the process cycle time is reduced. The redefinition of the process and the suggestion of the technological support will be described in section 6.

## 6 Business Process Reengineering – the case of competences certification process

The chosen process presents a practical application of the methodology suggested in section 4 (Figure 18). Based on the process map for the process Competences Certification, its responsibility matrix (Figure 22) and each sub-process business model current situation provided by GAMC (appendix K), the SSA and SSN (appendices M and N) were developed in a way that also represents the current process.

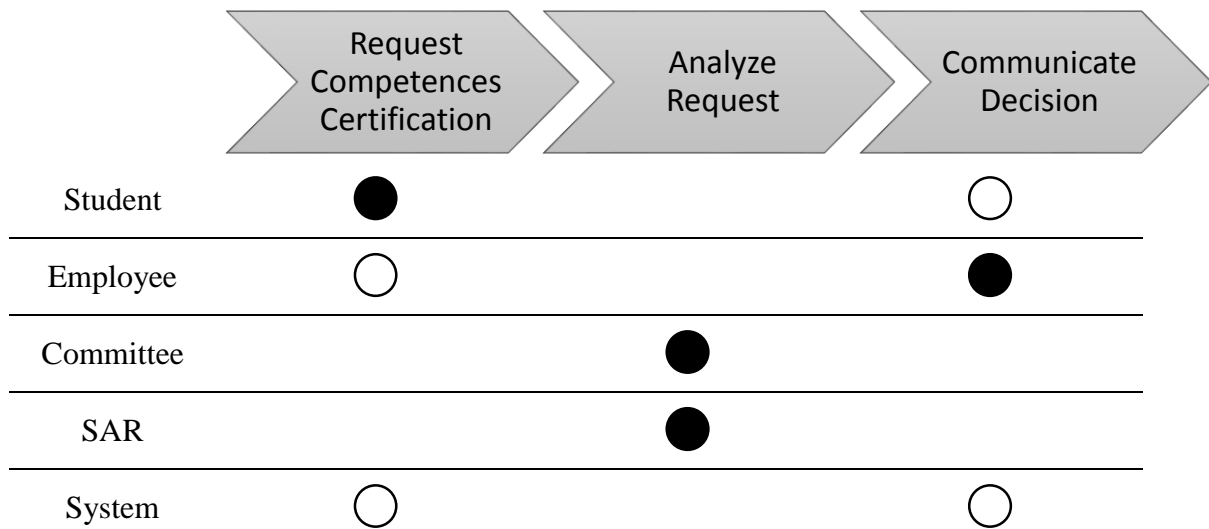


Figure 22. Sub-processes and Responsibility Matrix for the Competences Certification process.

A first observation helps to understand that even though process map and responsibility matrix have the same elements of the SSA (Figure 23), the artifact based on the SD allowed to realize that another sub-process was justified. This can be explained by comparing a business process model with the SSN. The fact that process modeling lists the activities of each actor but does not study the actors' interactions with each other or with the system, is the reason why SD show another perspective of the process.

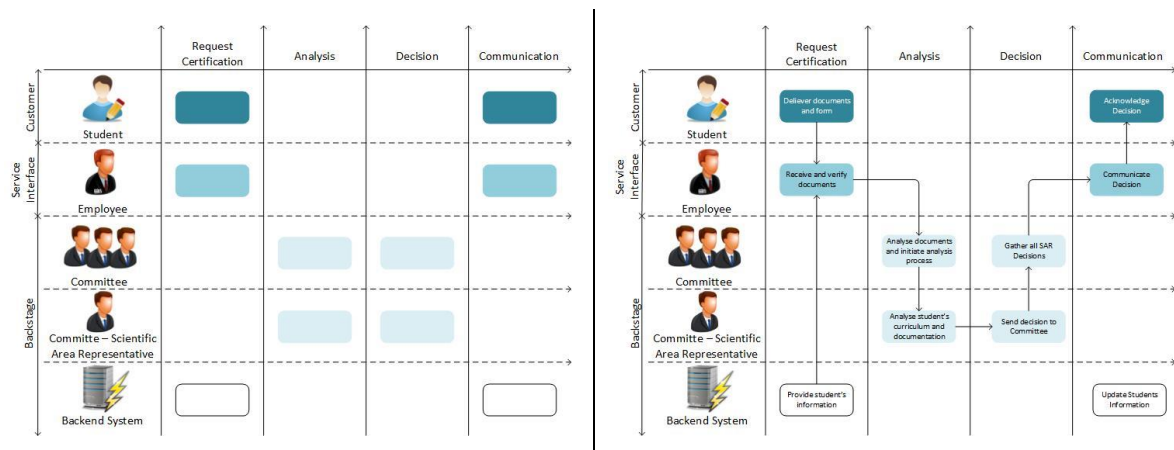


Figure 23. Current Service System Architecture and Service System Navigation

SSN can be understood as an intermediary level of detail between a process map and a business process model. An example of that is the separation of the Analyze Request sub-process in two phases in the navigation. In a model like a swimlane, it can be represented as one sub-process. In the SSA it can appear as one stage of the process in which only two actors participate. But when detailing the flow in the SSN, it is necessary to separate in Analyze Request and Decision. This is also an advantage of the SSN, it helps understanding that there will be two different interactions, despite being between the same players.

The SSA, with four stages, shows how the student does not have any perception about what happens during the intermediate stages. In a process model, this could even appear as a separated process linked to Certification Request. However, the SSA confirms that the back office activities are as important as the front office to create a good customer experience.

In a case like the Competences Certification there is no activity for the student when the request is under analysis. Although, the process can be improved in a way that the student's perception increases positively even without having any task. This can be accomplished with a IS support, as it will be shown.

By observing the as-is process model (appendix K) it is clear that the system is just used to store information and it is not a tool for any task. Based on the existent IS support for other requests and the helpdesk, it was possible to redesign the process as to include that same IS support and improve the students' perception about it. Figure 24 and Figure 25 show a part of the sub-process Request Competences Certification.

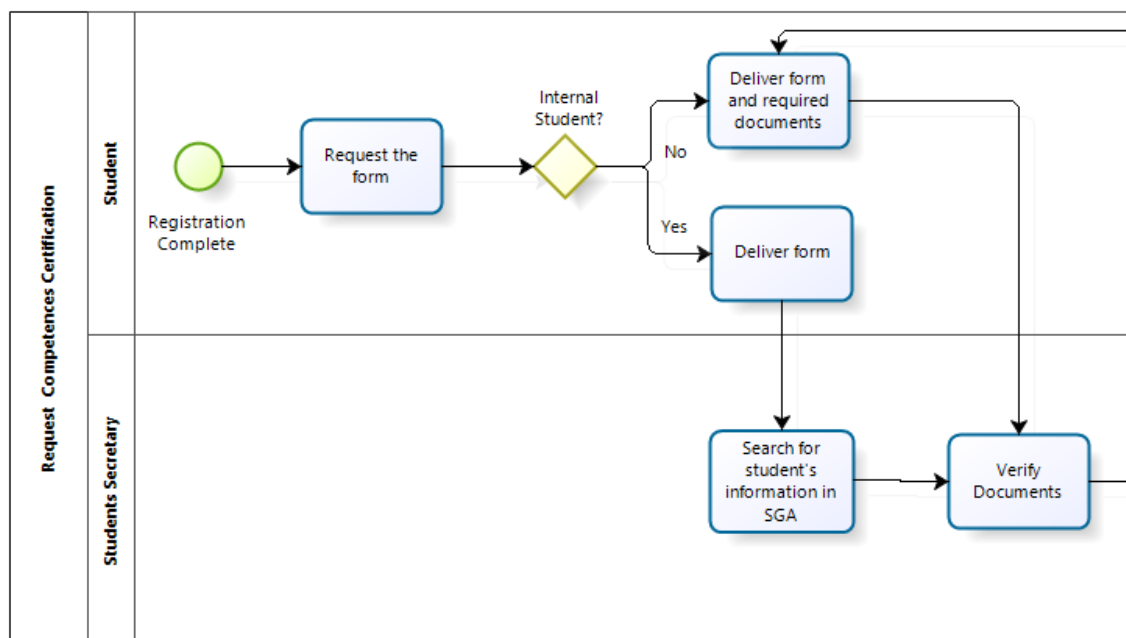
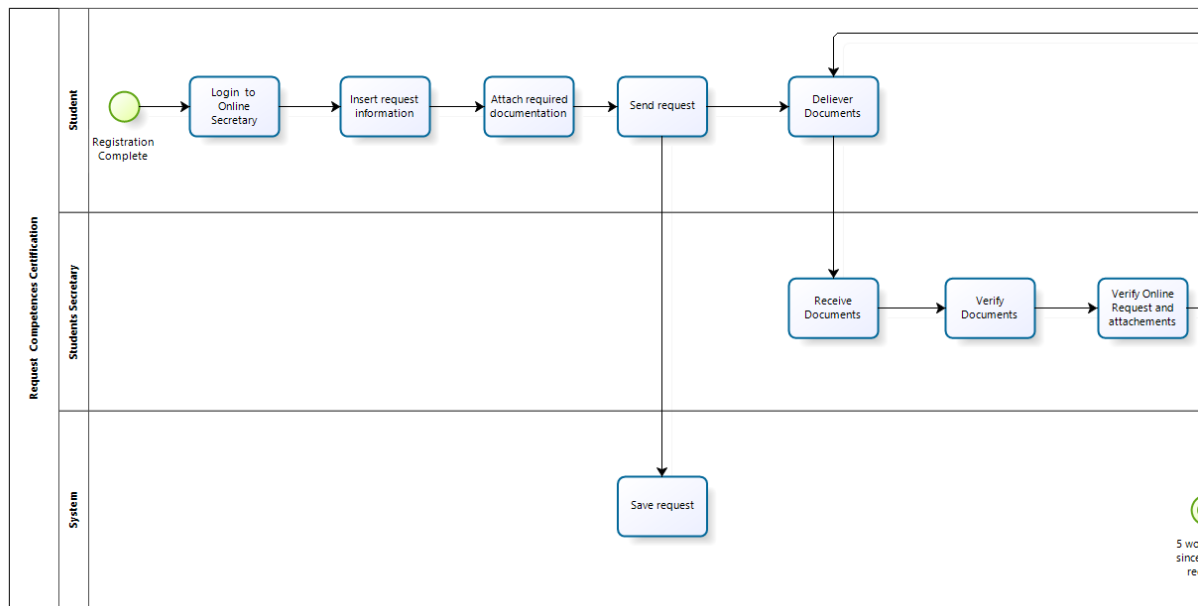


Figure 24. Business Process Model as-is - sub-process Request Competences Certification





**Figure 25. Business Process Model To Be - sub-process Request Competences Certification**

This is a part where the suggested process is completely different as the student does not have to go to the physical secretary in the beginning. He/she only needs to insert the information on the SO. Naturally the documents still have to be delivered. However the request is already in the system causing the process to be faster, since the employee only needs to validate and does not need to insert any information. For the student, the waiting time will decrease since for all participants the process starts when the request is validated. Before, the process would start when the documents were delivered at the secretary, but for the committee it would only start when the documents were delivered at the committee's office.

Other tasks that can be improved with the IS support are related to the Scientific Area Representative (SAR), that instead of analyzing the documentation on paper just needs to consult a PDF file and can write the decision in the system so it will be seen by the committee president. This will also fasten the process since the SAR does not need to go personally to the committee's office (appendices K and L).

Still related to the business model, it is important to note the difference at the end of each sub-process. While the as-is process uses the *signal event throw* and *catch*, the proposed process uses the *link event*. The reason is that the current process does not assure the continuous process in time. It may take a certain time before the SAR goes to the committee to analyze the request. However, the IS support will allow for a continuous process, therefore the link event is more accurate for this case, meaning that the process could almost be seen continuous in time.




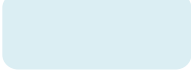
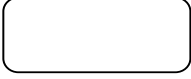
Based on the current SSA and SSN, the new service proposal was designed including the IS interface. In fact, this was made in parallel with the process redesign since these artifacts helped defining who would be involved and a possible workflow. After having the final SSN the process model was updated and complete. The utilization of both perspectives helped understanding how the process can be more efficient by improving professors' tasks, but also improving the student's experience with the academic services. For instance, the SSN showed that the student must interact with the services in the beginning and the end of the process. However, with a IS support, the student may consult the status request whenever needed. This

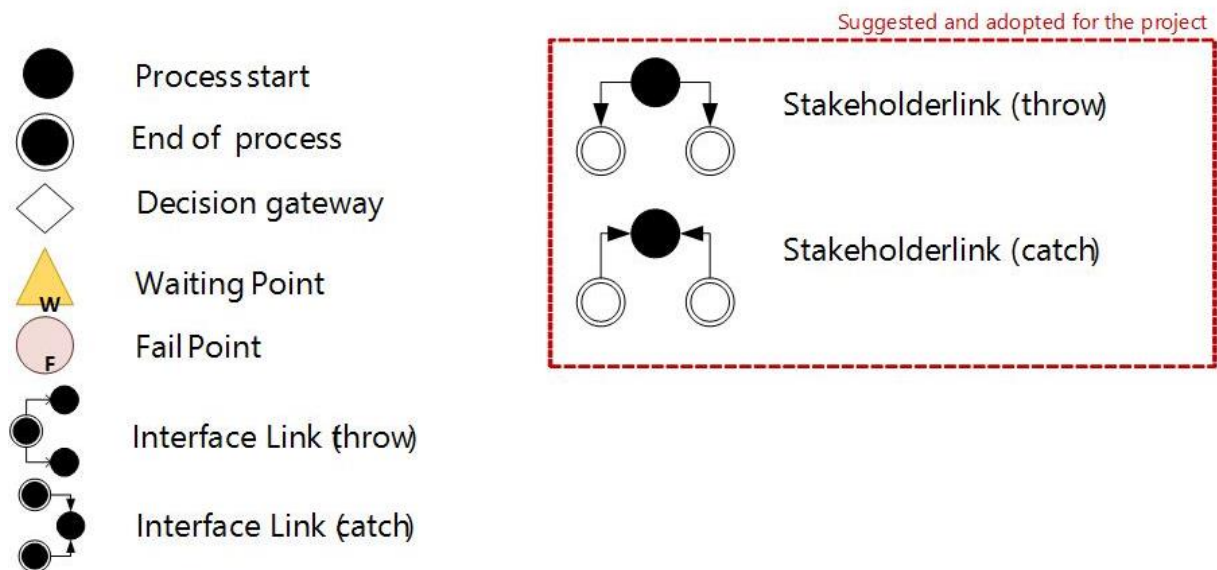
aspect is not visible in a classical BPMN swimlane model. So, the business model shows what tasks are really performed during the process, but the SSA maps all possible actions, and the SSN maps the most likely to occur workflow.

After the business process model was complete, based on the new SSN it was possible to analyze the touchpoints and create the SEB for each one. Without having the detail of a task workflow diagram, they enable the discussion of some details that are not visible in the business model. From here on, it will be described how SEB can help decide about the implementation.

The SEB diagram is most used to map customer interactions. Although, in this case, the customer does not interact with the service provider during the entire process. Since this project is based on the hypothesis of integrating internal and external perspectives of the service, the blueprints were created not only to map the customer interaction but they also represent the service provider facilitator interactions with the service. This is visible in the proposed SSA, where the dashed squares represent that the Internet Interface serves as an interface for the customer but also for the service provider facilitator (Table 16). In this case, this will happen when the SAR is analyzing the request through the system. The non-interaction in parts of the process from the student would cause to have a blueprint with no activity in the first row. So, to focus on the actions of the service facilitator, those phases of the process were mapped having the system user as the center of the experience (Figure 26). With this, it is possible to understand if the process is also viable to the internal participants. This aspect meets complains of some interviewees, who state that IS usually implement processes that do not reflect the reality. Having a SEB with focus on the user helps understanding if the process is similar to reality or if it will impose undesired tasks. The level of similarity to reality will always depend on the level of desired innovation.

**Table 16. Service System Architecture Notation**

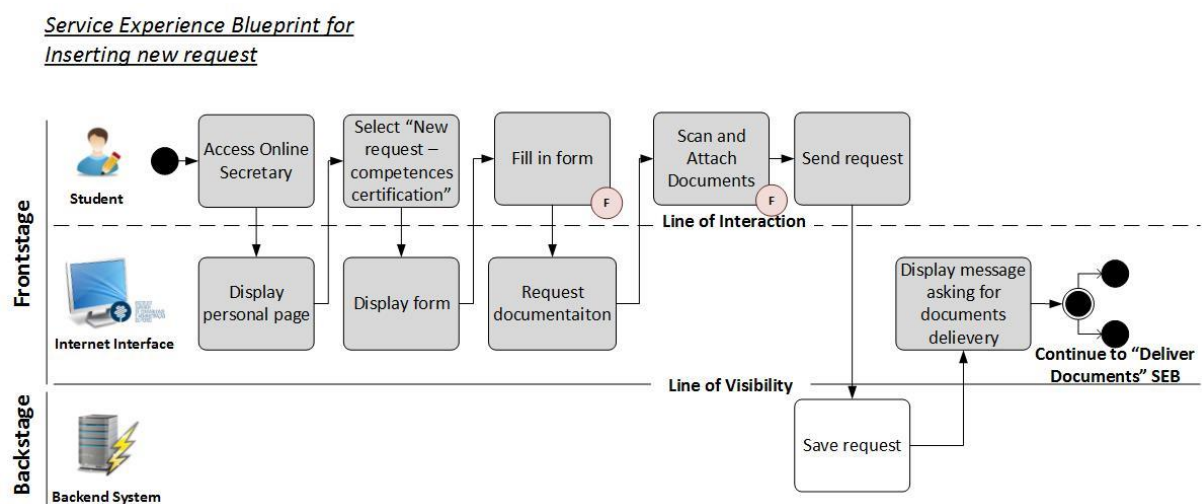
<b>Adopted Notation</b>	<b>Adopted Notation Meaning</b>
	Activities for which the student is responsible
	Activities in which student and employee interact with the Webinterface
	Activities for which the employee is responsible
	Activities for which a professor is responsible
	Activities performed only in the backstage



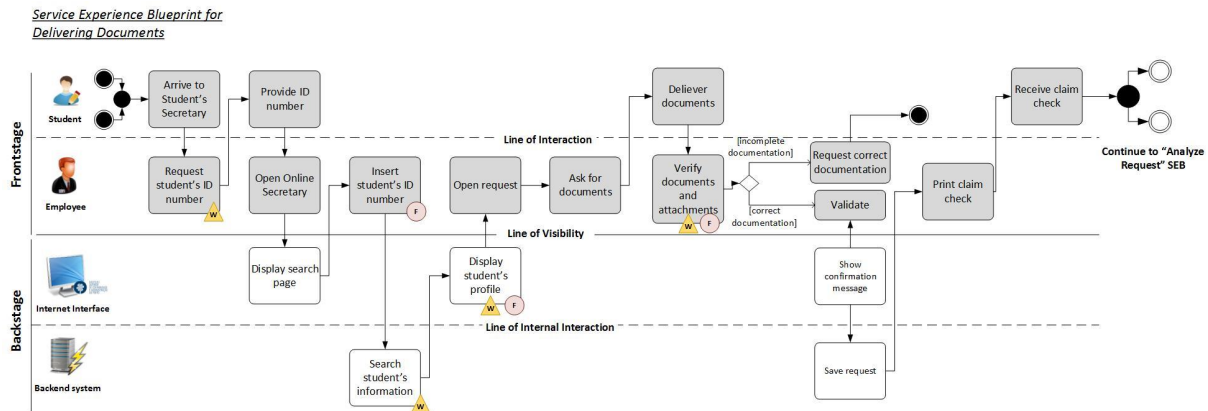
**Figure 26. Service Experience Blueprint Notation**

The process is divided in five SEB. There are more SEB than sub-processes for two reasons. The already mentioned separation of Analyze Request and Decide phases, and the existence of two touchpoints in the first phase, the Request Insertion online and the Documents Delivery (appendix O).

The first interaction is mapped in the “SEB for Inserting Request” (Figure 27). Using the interface link it connects with the “SEB for Delivering Documents” (Figure 28). The second is also an example of an interaction between the customer and the service provider, who interacts with the online interface.



**Figure 27. Service Experience Blueprint for the activity Insert new request**



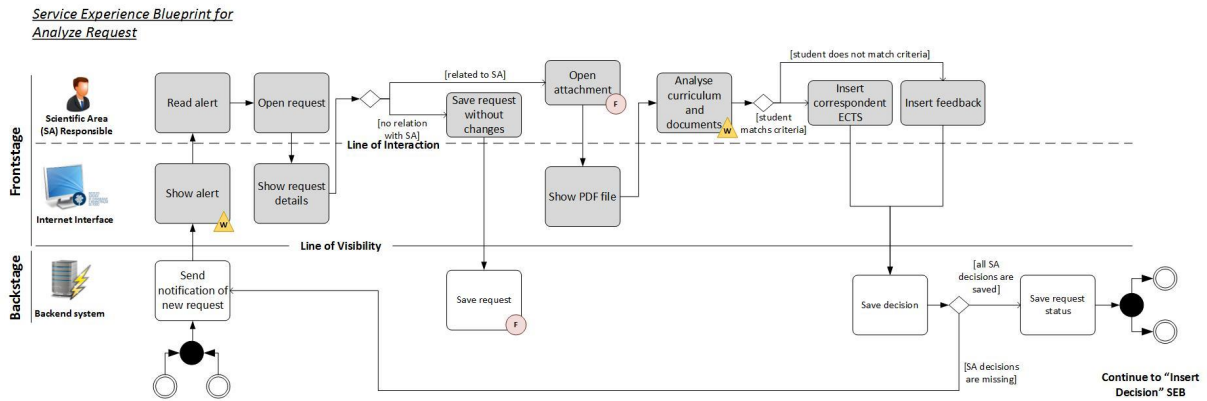
**Figure 28. Service Experience Blueprint for the activity Deliver Documents**

In comparison with the sub-process model Request Competences Certification, the SEB diagram adds one lane, the internet interface. The fact that the interface is represented as an actor differs from the BPMN swimlane model. It becomes clearer what, how, when and where the activities are performed, integrating the MSD model in the Zachman Framework. It also helps representing the failing and waiting points. As an example there is the “Display student’s profile page”. The reason for failure is in the backend system, but the perception of the user will associate with a SO failure. These diagrams also include the lines of visibility and interaction, bringing another perspective when managing customer experience. This is why SEB have more detail than a swimlane model but less detail than an activity diagram.

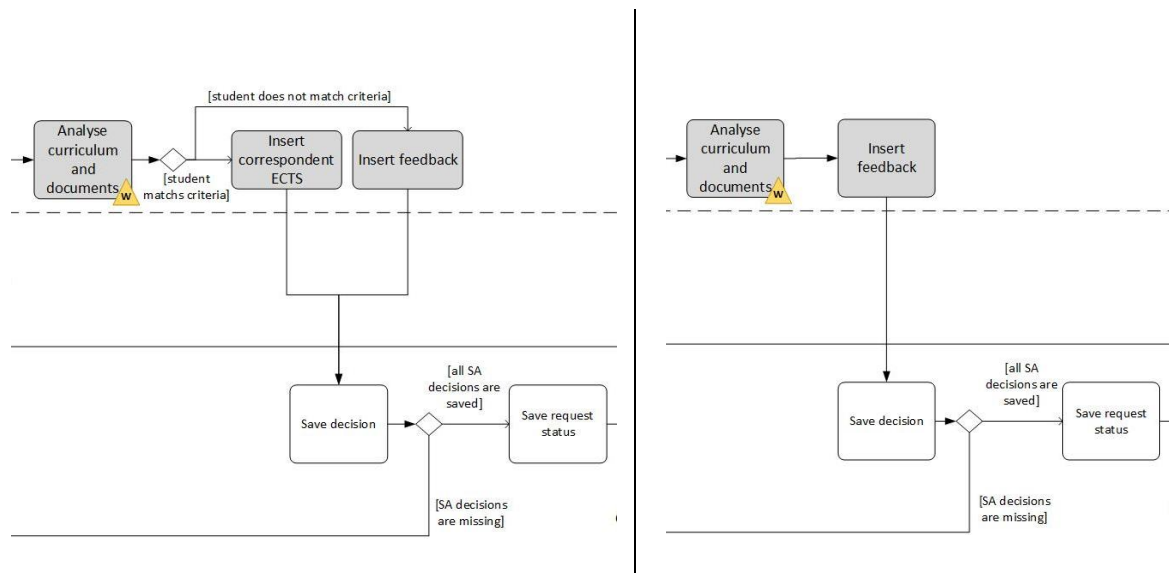
The Delivering Documents SEB (Figure 28) ends with a suggested element, the stakeholder link. Such as the interface link indicates that the customer continues his/her journey interacting with the service in other interface, the stakeholder link indicates that the service provision continues without the interaction of the main customer (this case the student) and another stakeholder is the focus of the service design. This is helpful in the case where the service provision is done with the resource to a software or an online platform with several users. This focus on another stakeholder approximates the SEB with the activity diagram, thus helping the relation between service designers and programmers.

In the case presented, after delivering the documents, the process will continue with the analysis of the request (Figure 29) by the SAR as shown in the process model and in the SSA.

In one hand, the focus is the SAR since the goal is to improve the user experience. On the other hand, the team responsible must keep in mind that the actions should reflect a final service that satisfies the customer. An example of this is the detail on Figure 30. If the first option is implemented the student may consult immediately the ECTS granted, even if he later has to pick up an official document. If the second option is implemented the student can only know the request status. At the same time, the second option imposes that the president reads all the feedback to organize the information and send it to the secretary. If the first option is chosen, the president can read the information in an easier way and the information is ready to be imported to the document by the secretary.



**Figure 29. Service Experience Blueprint for the activity Analyze Request**

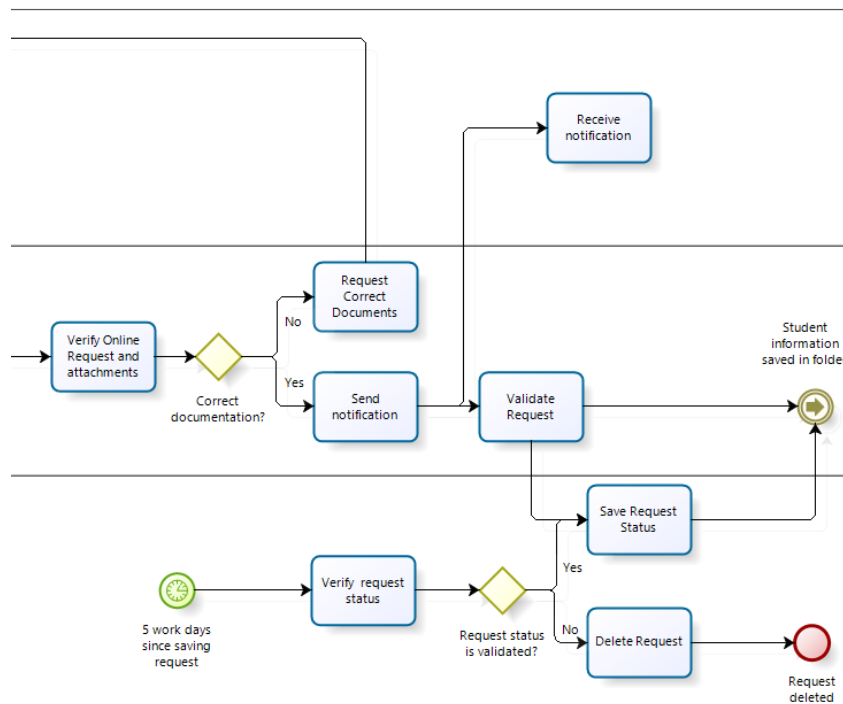


**Figure 30. Comparison of detailed tasks for the Analyze Request SEB.**

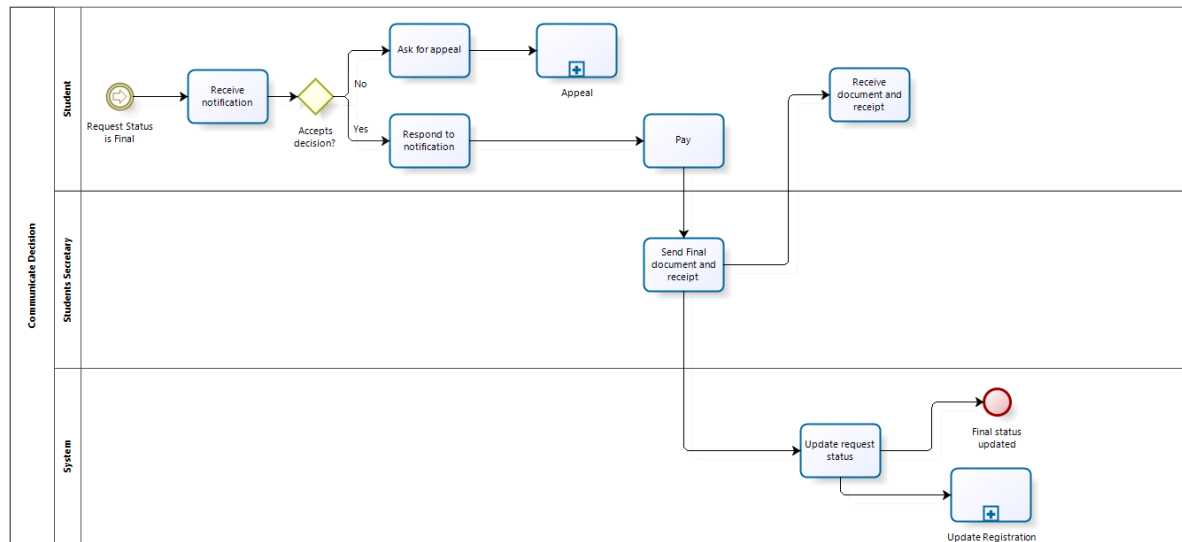
However, since this project had the constraint of being similar to the Request and Helpdesk processes already implemented, the second option is the most likely to be implemented. It presents the advantage of being similar to the current process but with IS support.

The final workflow does not add much to the process itself because of school regulations. If there were less constraints some aspects could be considered but it would depend on the approval from other stakeholders that were not involved in the project.

Examples of that are the delivery of documents and the delivery of the final document (Figure 31 and Figure 32). Considering the intersection between Student's Secretary opening hours and classes schedules, ideally the student would do most of the activities without depending on the opening hours. That can be solved if the student could leave the documents in the secretary mail box and then receive a digital claim check notifying about the reception of the documents. The same can be done in the end of the process. The final decision can be shown in the students profile page and an acknowledgement response can be demanded, thus registering digitally that the student was informed. Finally the document can be sent by email, only if the payment is complete. That payment can use online resources or ATM references.



**Figure 31. Request Competences Certification sub-process - Deliver documents detail**



**Figure 32. Communicate Decision sub-process - digital process.**

As for the SEB (appendix P), as expected, they show a lower interaction with the physical services. In fact, there is no interaction at all since the documents are delivered at the mail box. Only the employee will interact with the system's interface. This could be an example of the stakeholder link. But using the notation from Table 16, with dashed textures, it is possible to represent it all in one diagram. The stakeholder link can be used when there are any student's activities. As in this case, the trigger of the process is the student delivering the documents and

the end is the reception of the notification, therefore both actors that interact with the system shall be present in the diagram.

In the activity Acknowledge Decision, the student goes from interacting with the employee who interacts with the system, to interacting directly with the system at the same time that employee interacts with it (Figure 33).

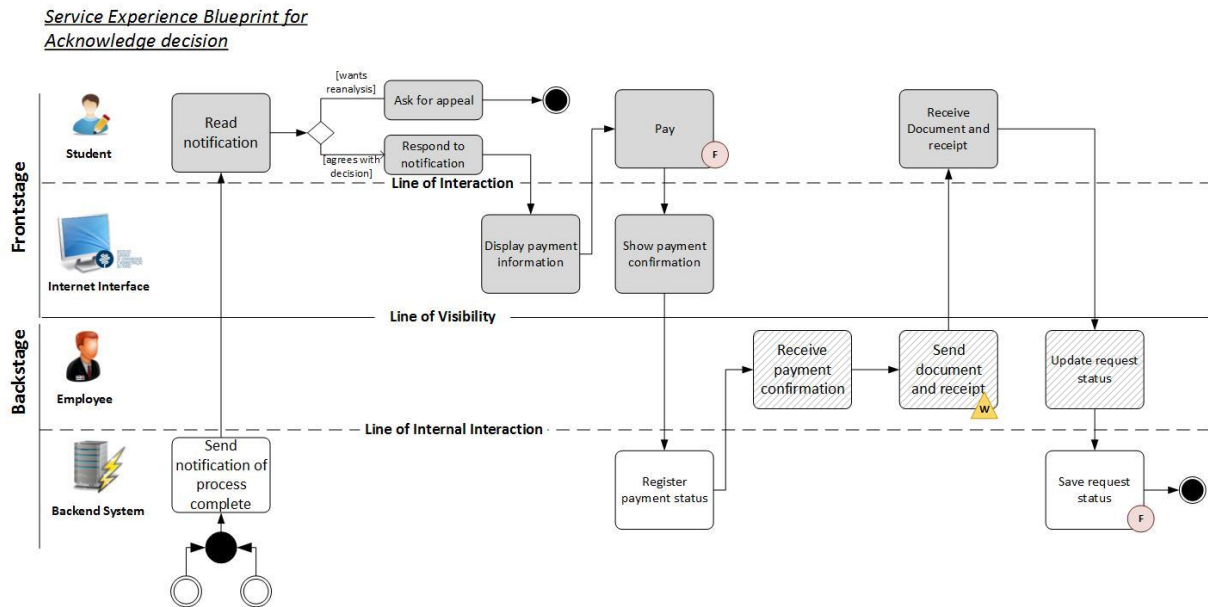


Figure 33. SEB for Acknowledge decision – Web-interface

Initially, maintaining the process closer to the current situation may help the implementation of the technology workflow. Nevertheless, considering these last two suggestions could please the students as they will feel more control in the process. Providing the tools to be more active in the process will transfer some responsibilities to them, thus if the process takes longer it will be their responsibility.





## 7 Conclusion and future work

The focus of this research was the redefinition of business process within HEI context. Most of the management activities are performed in the back office. Then, management in HEI is easily associated with BPM and IS support in management activities as to achieve internal efficiency. However, a bridge with services industry can be established if students are considered as customers.

For a complete involvement of all stakeholders, this project approaches the issues of BPR with methodologies from EA and SD. The first group aims to improve internal processes, and the second has the objective of managing customer experience. Based on this two perspectives, an integrative approach is proposed with references to MSD, EAD and EAP methodologies.

The beginning of a project and the end are very similar in both perspectives. They state the mission and goals of a project, defining a team and planning all phases. In the end, there is an implementation plan and a conclusion of the project. The integration here suggested is more visible during the reengineering process itself. Given an existent process map, it is possible to build the SSA and SSN and the last can serve as an input for a business process model. It will be an iterative process, being incorrect to establish an order for what artifact should be developed first. As the described case of Competences Certification illustrates, in the end all diagrams should represent the same with different levels of detail and different focus. The BPM diagrams will be concerned on representing tasks and workflow as the SD diagrams will focus on mapping all actors and their interaction. This does not mean that actors are not present in BPM or workflow is not present in SD. They simply have different focus, and their simultaneous usage represents an advantage.

The choice of a HEI is related to the fact that a professor is not only a customer of the academic services in tasks like selecting classes schedules but also is a service provider for the student. This leads to a different approach of the MSD method, where the final customer is always the focus. If there is a participant acting as user and service provider, there is an intermediary layer of service that will be reflected in the main customer's experience.

Another hypothesis of this project was the integration of MSD in the Zachman's framework matrix cells. The proposed methodology supports this integration and the resulting process diagrams are a proof that different artifacts fit the same cells. As an example, the SEB and the business process model represent the workflow, and therefore can be placed in the Function column for the Conceptual perspective.

The case of ISCAP was used to show how this methodology can be used on a real case. Having the institution business process models and its current IS description was possible to redesign a selected process having the students experience in mind. The students and professors input was retrieved by online questionnaires. The results helped in the selection of the process. The proposed redesigned process has a high potential of implementation due to the interest of the responsible team for the IS on increasing the system's functionalities. It has a high potential of acceptance from the students' perspective because it increases their autonomy and their perception of the back office tasks and, not less important, it simplifies professors and employees tasks and interactions.

The limitations of this project can be overcome with time. Both time for the project and time spent by all participants in the process. It would be interesting to involve students, professors and employees in the validation of the process. Simultaneously, it would be important a requirements elicitation and prototyping phases before the complete implementation to help

with the mentioned validation. Another aspect was the fact that applications should be kept the same. This can be considered an advantage to the faster implementation but at the same time it is a constraint to process innovation. For example, in the future, the process can be even faster if the sub-process Analyze Request can be performed in parallel by all of scientific areas representatives. This would require that technology and applications were not a constraint as in the presented case.

Without this constraint it would be interesting to extend this project to more complex processes such as the scheduling classes and students allocation to classes. Since the school is currently documenting all internal processes, it could be the time to perform what might be called a customer-centric business reengineering project.

The proposed methodology has the potential to help a project like this since it adds three major aspects. The integration of MSD and EAD methods, the utilization of a new layer of service in the Service System Design and the integration of the MSD artifacts in the Zachman's Framework.

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## APPENDIX A: EAD and EAP detailed steps

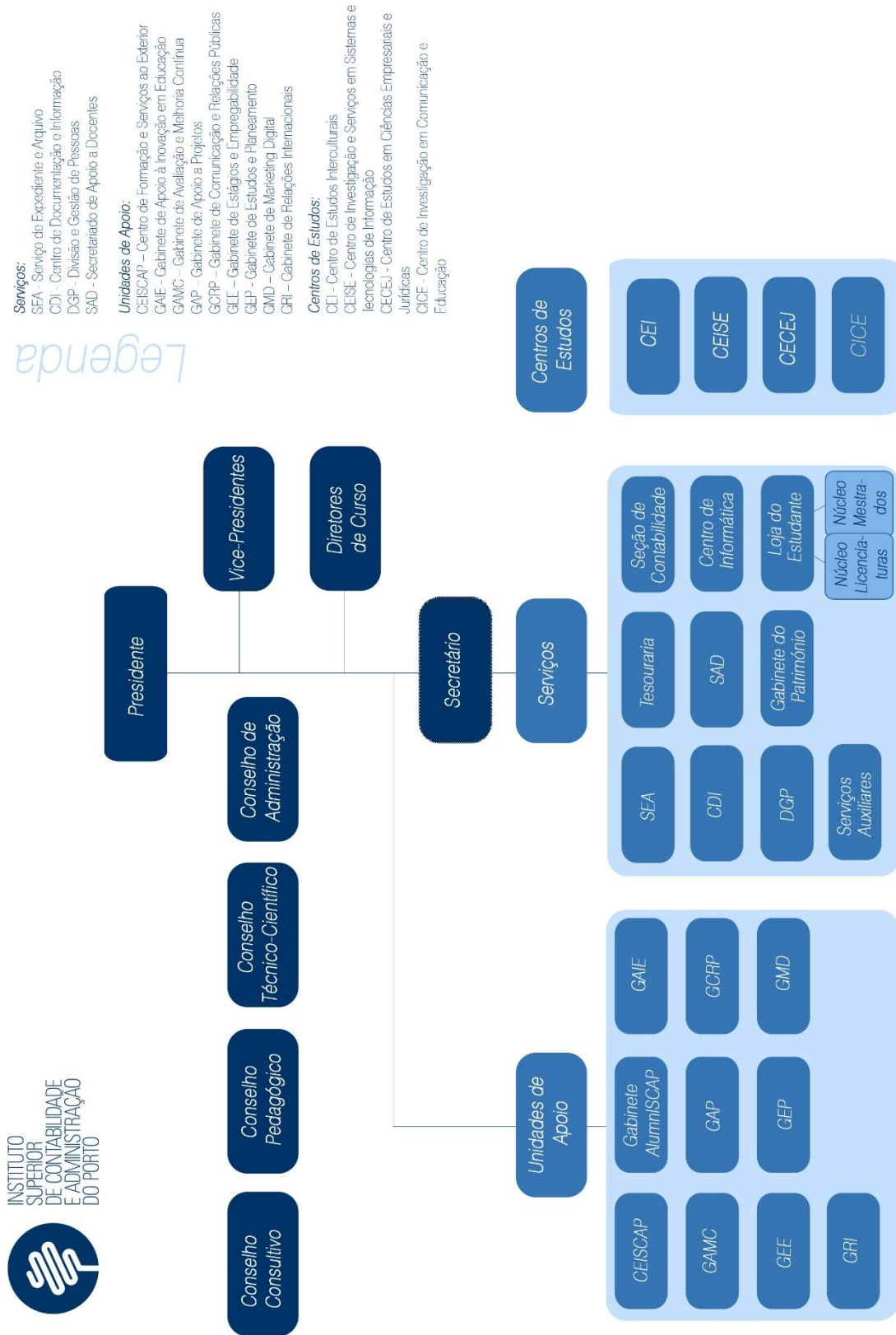
**Table 17. Enterprise Architecture Planning project steps (Spewak and Hill 1993)**

Steps	Deliverables
1. Planning Initiation	Scope, objectives, vision, methodology, tools, planning, team, presentations, workplan
2. Business modeling	Organization structure, preliminary functional business model
3. Enterprise survey	Complete functional business model
4. Current Systems and Technology	Information Resources Catalog, system schematics
5. Data Architecture	Entity definitions, Entity relationship diagrams, entity to function matrix, data architecture report
6. Applications Architecture	Definition of application, application matrices, impact analysis, application architecture report
7. Technology Architecture	Data/application distribution, technology architecture report
8. Implementation Plan	Application sequence, migration plan, costs and benefits, success factors and recommendations
9. Planning Conclusion	Final report, presentation
10. Transition to Implementation	Improvements to organization, policies, standards, procedures, detailed project plan

**Table 18. Enterprise Architecture Design project phases (Velho 2004).**

<b>Phase</b>	<b>Objectives</b>	<b>Results</b>
<b>1. Initiation</b>	Project planning considering conditions for success	Scope, method, tools, team, project plan
<b>2. Strategic-Operational Summary</b>	Strategy definition and its implications on IT systems	Change factors
<b>3. Business Architecture</b>	Process model characterization and information needs	Business process model
<b>4. Current Systems &amp; Technology</b>	List of information systems and technology currently in use.	Information Resources Catalog
<b>5. Management IS and ICT Principles</b>	Definition of basic policies to be applied on IT systems decisions	Management IS and ICT principles document
<b>6. Information Architecture</b>	Business entities structure definition in a global perspective	Entities' relationship diagram
<b>7. Applications Architecture</b>	Applications portfolio	Applications interaction matrix
<b>8. Technology Architecture</b>	Data and Applications supporting Technology infrastructure	Technology schemes
<b>9. Governance Model</b>	Organization and distributions of ISA management responsibilities	Governance Structure
<b>10. Implementation Plan</b>	Implementation plan for data, applications and technology architectures	Implementation plan
<b>11. Conclusion</b>		Final report

## APPENDIX B: ISCAP's Organization Chart

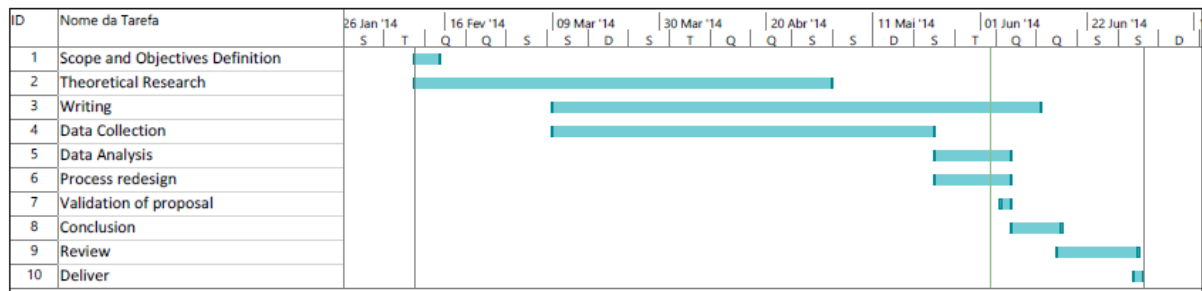


## **APPENDIX C:           Main Services Available in Online Secretary**

1. Query and update personal data
2. Course plan (registered classes and respective results)
3. Class information (program, assessment, professors, etc.)
4. Timetable
5. Class map (date, contents, attendance, etc)
6. Partial and final grades
7. Exams calendar
8. Exams Surveillances
9. History (student's academic path)
10. Special status
11. Tuition and fees
12. Evaluation type option
13. First time registration
14. Registration renewal
15. Diploma and Certificate Request
16. Grades insertion
17. Digital signature with Citizen Card
18. Messaging
19. Short Message Service
20. Copy and Printing Services
21. Requests
22. Helpdesk
23. Personal Files (files upload)
24. Search by categories



## APPENDIX D: Gantt Chart



## APPENDIX E: Students Questionnaire

The goal of this questionnaire is to understand how the Online Secretary and other services from ISCAP are useful in the daily students' activities.

Throughout time, Online Secretary has been offering more services and functionalities. Its objective is to decrease time spent in problem resolution and bureaucracy. The question now is if the services respond to the students' needs and if the desired interaction satisfies the students.

This questionnaire is part of a project with the Porto's University. The answers are totally anonymous and will only be used to a statistics analysis.

Thank you for your time.

- 
- ☐ Only one option available
  - ☐ More than one option available
- 

### 1. Gender

- ☐ Male
- ☐ Female

### 2. Age

- ☐ 18-25
- ☐ 26-30
- ☐ 31-35
- ☐ 36-40
- ☐ 41-50
- ☐ 51-60
- ☐ >60

### 3. Professional situation

- ☐ Daily student
- ☐ Daily working student
- ☐ After-work student
- ☐ After-work working student

### 4. Quantity of registrations

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ >4

### 5. How do you usually interact with the academic services?

- ☐ Online Secretary
- ☐ Students' Secretary – opening hours
- ☐ Students' Secretary – telephone
- ☐ Students' Secretary – email
- ☐ Students' Association Help
- ☐ Other: \_\_\_\_\_

6. For the following criteria, please rate from 1 to 6 your experience with the Academic Services.  
(very bad, bad, acceptable, good, very good, excellent)

	1	2	3	4	5	6	DK/NA
Service speed							
Information quality							
Problem resolution speed							
Workflow							
Organization							
Internal Communication							

7. For the same criteria, please rate from 1 to 6 your experience with the Online Secretary and other  
Information System Services.  
(very bad, bad, acceptable, good, very good, excellent)

	1	2	3	4	5	6	DK/NA
Service speed							
Information quality							
Problem resolution speed							
Workflow							
Organization							
Internal Communication							

8. How often do you use ISCAP's Online Services?

- ☐ Everyday
- ☐ More than once a week
- ☐ Once a week
- ☐ Less than once a week
- ☐ Rarely

9. What activities do you perform online?

- ☐ First Registration (login attribution)
- ☐ First Registration (classes selection)
- ☐ Registration renewal (classes selection)
- ☐ Schedule changes
- ☐ Requests
- ☐ Status requests
- ☐ Helpdesk
- ☐ Printing Services
- ☐ SMS
- ☐ Exams registration
- ☐ Assessment Type
- ☐ Contact with teachers
- ☐ Messaging
- ☐ Fees and other payments
- ☐ Other: \_\_\_\_\_

10. From these activities, is there any that you'd rather perform locally?

- ☐ Yes  
Which? \_\_\_\_\_
- ☐ No

11. From the indicated activities, how to you rate your interaction with the system?  
(very bad, bad, acceptable, good, very good, excellent)

	1	2	3	4	5	6	DK/NA
First Registration (login attribution)							
First Registration (classes selection)							
Registration renewal (classes selection)							
Schedule changes							
Requests							
Status requests							
Helpdesk							
Printing Services							
SMS							
Exams registration							
Assessment Type							
Contact with teachers							
Messaging							
Fees and other payments							
Outro: _____							

12. Do the online services respond to your needs?

1 (none)	2 (few)	3 (some)	4 (many)	5 (most)	6 (all)

13. If there are flaws in the services, what is their origin?

- ☐ There are no flaws
- ☐ System failures
- ☐ Lack of system functionalities
- ☐ Human failure
- ☐ Lack of organization
- ☐ Communication failures
- ☐ Good organization and bad execution
- ☐ Other: \_\_\_\_\_

14. Is the any service, from the currently available, that you would like to have online?

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15. Do you have any suggestions about how to improve the any of the mentioned services? You can write here or send na email to [spduarte@iscap.ipp.pt](mailto:spduarte@iscap.ipp.pt) (Sérgio Duarte)

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16. If you are willing to contritbute with your opinion and participate in this project please leave your contact (email):

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## APPENDIX F: Professors Questionnaire

The goal of this questionnaire is to understand how the Online Secretary and other services from ISCAP are useful in the daily institution activities.

Throughout time, Online Secretary has been offering more services and functionalities. Its objective is to decrease time spent in problem resolution and bureaucracy. The question now is if the services respond to the students and professors' needs and if the desired interaction satisfies the students.

This questionnaire is part of a project with the Porto's University. The answers are totally anonymous and will only be used to a statistics analysis.

Thank you for your time.

- 
- ☐ Only one option available
  - ☐ More than one option available
- 

### 1. Gender

- ☐ Male
- ☐ Female

### 2. Idade

- ☐ 18-25
- ☐ 26-30
- ☐ 31-35
- ☐ 36-40
- ☐ 41-50
- ☐ 51-60
- ☐ >60

### 3. Professional situation

- ☐ Part-time
- ☐ Full-time with certain term
- ☐ Full-time with uncertain term
- ☐ Full-time without term
- ☐ Exclusive Full-time with certain term
- ☐ Exclusive Full-time with uncertain term
- ☐ Exclusive Full-time without term

### 4. Working years:

- ☐ 1
- ☐ 2-5
- ☐ 6-10
- ☐ 11-15
- ☐ 16-20
- ☐ 20-30
- ☐ >30

5. Are you a member of any management council?

- ☐ Presidency
- ☐ Administrative Council
- ☐ Consulting Council
- ☐ Pedagogical Council
- ☐ Technical-scientific Council
- ☐ None
- ☐ Other Sub-council: \_\_\_\_\_

6. Do you know ISCAP organizational structure?

- ☐ Yes
- ☐ No

7. Do you know the Support Services and Offices?

- ☐ Yes
- ☐ No

8. Which do you usually use?

- ☐ Centro de Documentação e Informação
- ☐ CEISCAP - Centro de Formação e Serviços ao Exterior
- ☐ Centro de Informática
- ☐ GAIE: Gabinete de Apoio à Inovação e Educação - Núcleo de Audiovisuais e Multimédia
- ☐ Divisão de Gestão de Pessoas
- ☐ Gabinete de Ambiente e Simulação Empresarial
- ☐ GAIE: Gabinete de Apoio à Inovação e Educação - Núcleo de Educação
- ☐ Gabinete de Apoio a Projetos
- ☐ Gabinete de Avaliação e Melhoria Contínua
- ☐ Gabinete de Comunicação e Relações Públicas
- ☐ Gabinete de Estágios e Empregabilidade
- ☐ Gabinete de Estudos e Planeamento
- ☐ Gabinete de Marketing Digital
- ☐ Gabinete de Planeamento, Estratégia, Avaliação e Relações e Internacionais
- ☐ Gabinete de Relações e Internacionais
- ☐ Gabinete do Património
- ☐ Loja do estudante - Núcleo de Licenciaturas
- ☐ Loja de estudante - Núcleo de Mestrados?
- ☐ Secção de Contabilidade
- ☐ Secretariado de Apoio aos Docentes
- ☐ Serviços de Expediente e Arquivo
- ☐ Tesouraria
- ☐ Unidade de Operação de Recursos Audiovisuais e Multimédia
- ☐ None
- ☐ Other: \_\_\_\_\_

9. How do you usually interact with the academic services?

- ☐ Online Secretary
- ☐ Human resources – desk support
- ☐ Human resources – telephone
- ☐ Human resources – email
- ☐ Teachers' Support – desk support
- ☐ Teachers' Support – email
- ☐ Other: \_\_\_\_\_

10. For the following criteria, please rate from 1 to 6 your experience with the Academic Services.  
(very bad, bad, acceptable, good, very good, excellent)

	1	2	3	4	5	6	DK/NA
Service speed							
Information quality							
Problem resolution speed							
Workflow							
Organization							
Internal Communication							

11. For the same criteria, please rate from 1 to 6 your experience with the Online Secretary and other  
Information System Services.  
(very bad, bad, acceptable, good, very good, excellent)

	1	2	3	4	5	6	DK/NA
Service speed							
Information quality							
Problem resolution speed							
Workflow							
Organization							
Internal Communication							

8. How often do you use ISCAP's Online Services?

- ☐ Everyday
- ☐ More than once a week
- ☐ Once a week
- ☐ Less than once a week
- ☐ Rarely

13. What activities do you perform online?

- ☐ Students' attendance
- ☐ Summary
- ☐ Continuous evaluation
- ☐ Clock in log
- ☐ Requests
- ☐ Helpdesk
- ☐ Printing service
- ☐ SMS
- ☐ Assessment type
- ☐ Contact with students
- ☐ Messaging
- ☐ Other: \_\_\_\_\_

14. From these activities, is there any that you'd rather perform locally?

- ☐ Yes  
Which? \_\_\_\_\_
- ☐ No

15. From the indicated activities, how to you rate your interaction with the system?  
(very bad, bad, acceptable, good, very good, excellent)

	1	2	3	4	5	6	DK/NA
Students' attendance							
Summary							
Continuous evaluation							
Clock in log							
Requests							
Helpdesk							
Printing service							
SMS							
Assessment type							
Contact with students							
Messaging							

16. Do the online services respond to your needs?

1 (none)	2 (few)	3 (some)	4 (many)	5 (most)	6 (all)

17. If there are flaws in the services, what is their origin?

- ☐ There are no flaws
- ☐ System failures
- ☐ Lack of system functionalities
- ☐ Human failure
- ☐ Lack of organization
- ☐ Communication failures
- ☐ Good organization and bad execution
- ☐ Other: \_\_\_\_\_

18. Is the any service, from the currently available, that you would like to have online?

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19. Do you have any suggestions about how to improve the any of the mentioned services? You can write here or send na email to [spduarte@iscap.ipp.pt](mailto:spduarte@iscap.ipp.pt) (Sérgio Duarte)

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20. If you are willing to contritbute with your opinion and participate in this project please leave your contact (email):

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## **APPENDIX G: Interview Guide**

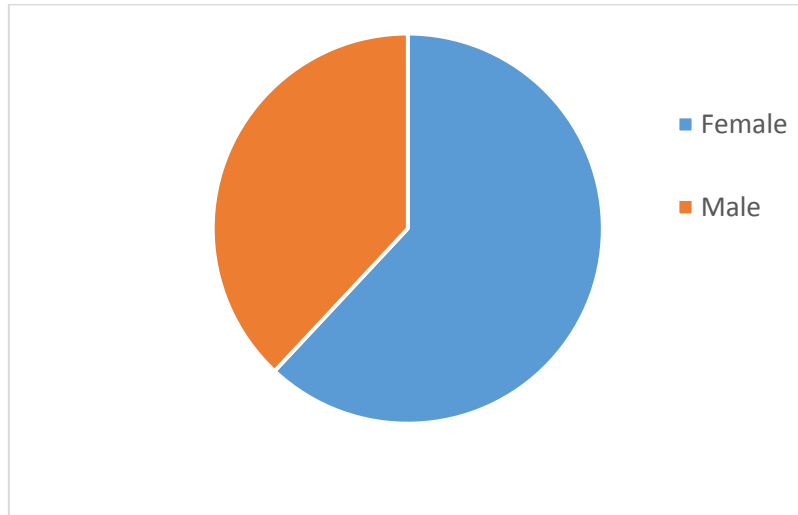
The interviews were very informal. However the interviewer tried to follow a logical conversation in order to obtain the required information for the project.

1. Personal Data
  - a. Age
  - b. Program
  - c. Freshman or Senior
  
2. Services Utilization
  - a. How often do you interact with the Academic Services?
  - b. How often do you use the Online Services?
  - c. What is your perception of the system functionalities? Do you use them all? Why?
  - d. What do you prefer: physical services or online system? Why?
  
3. Customer needs
  - a. Is any functionality unnecessary?
  - b. If you could, what would you add to the Online Secretary?
  - c. If you could, what would you improve? How?

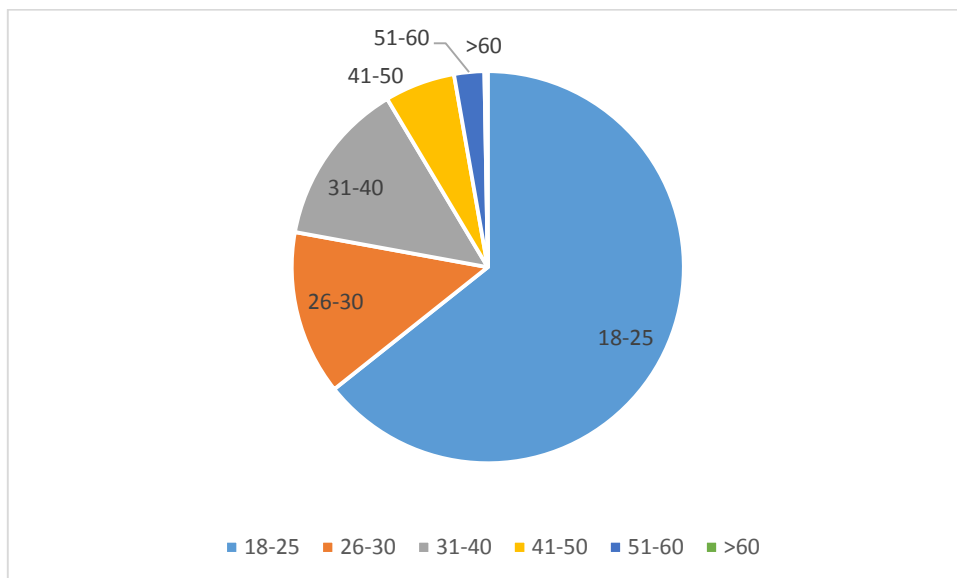
## APPENDIX H: Students Questionnaire Results

### 1. Sample characterization

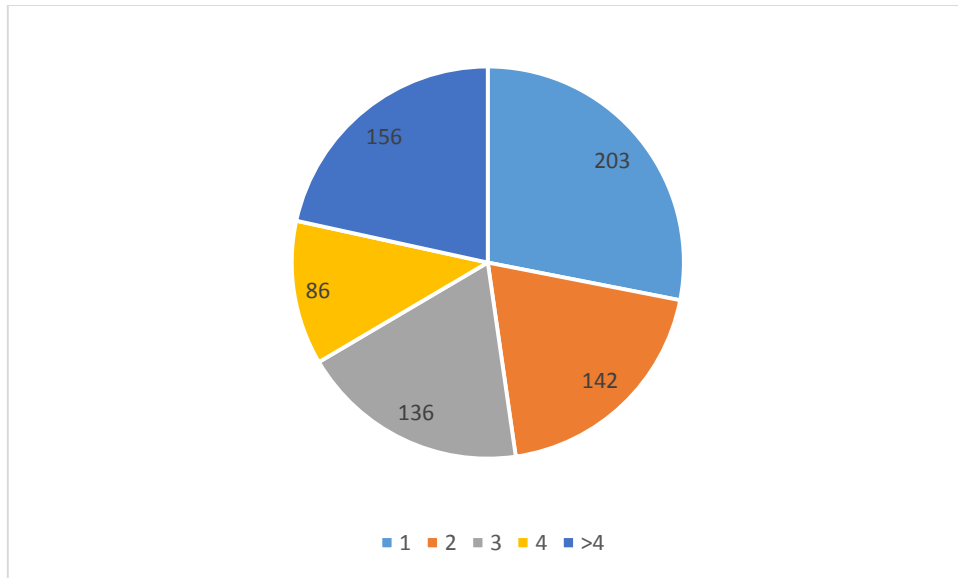
#### 1.1. Gender



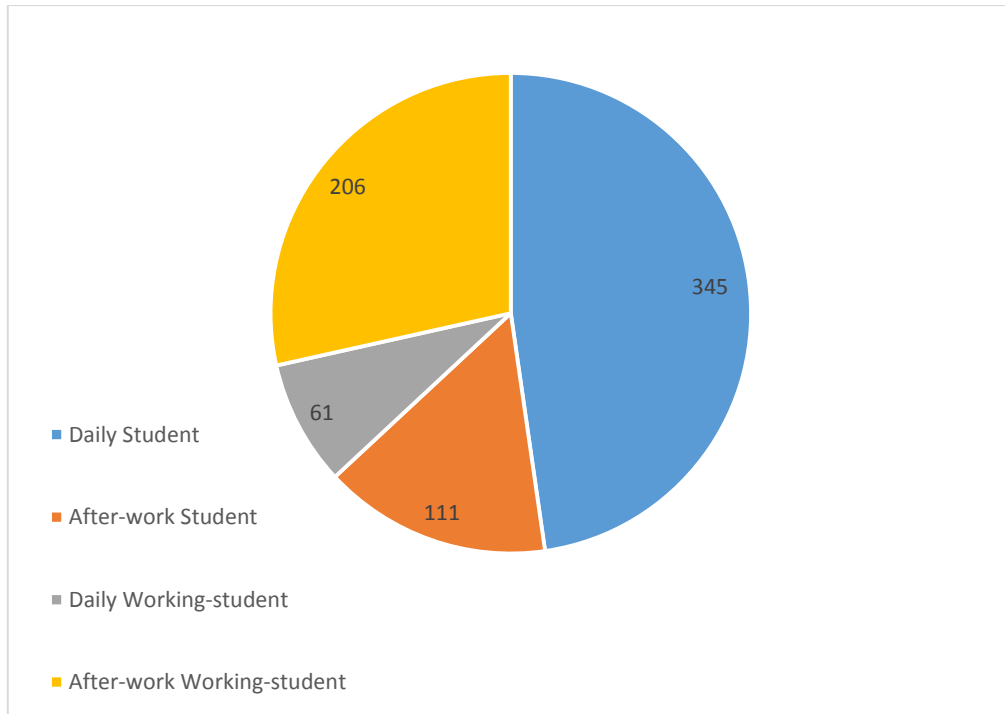
#### 1.2. Age



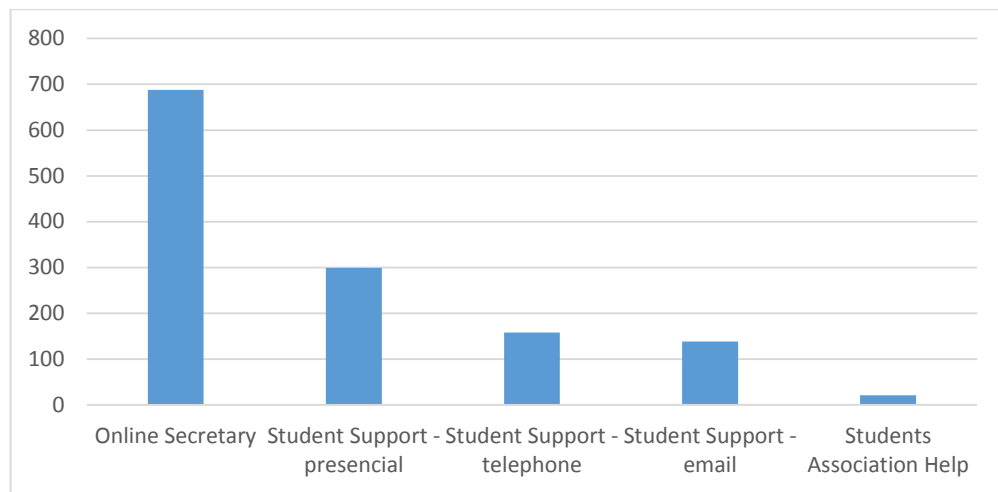
### 1.3. Number of Registrations



### 1.4. Type of student

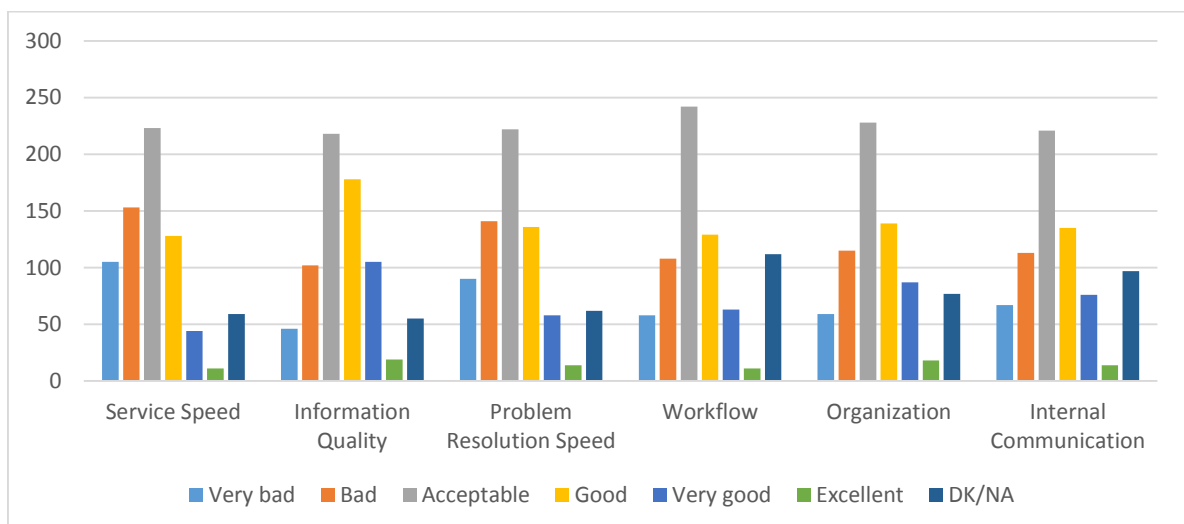


## 2. Academic Services Interaction



## 3. Experience with services

### 3.1. Academic Services (physical)



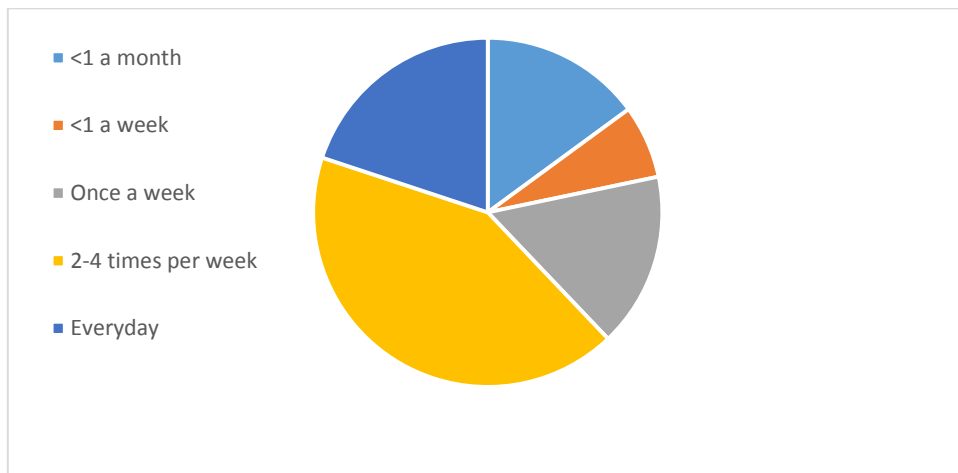
### 3.2. Online Services



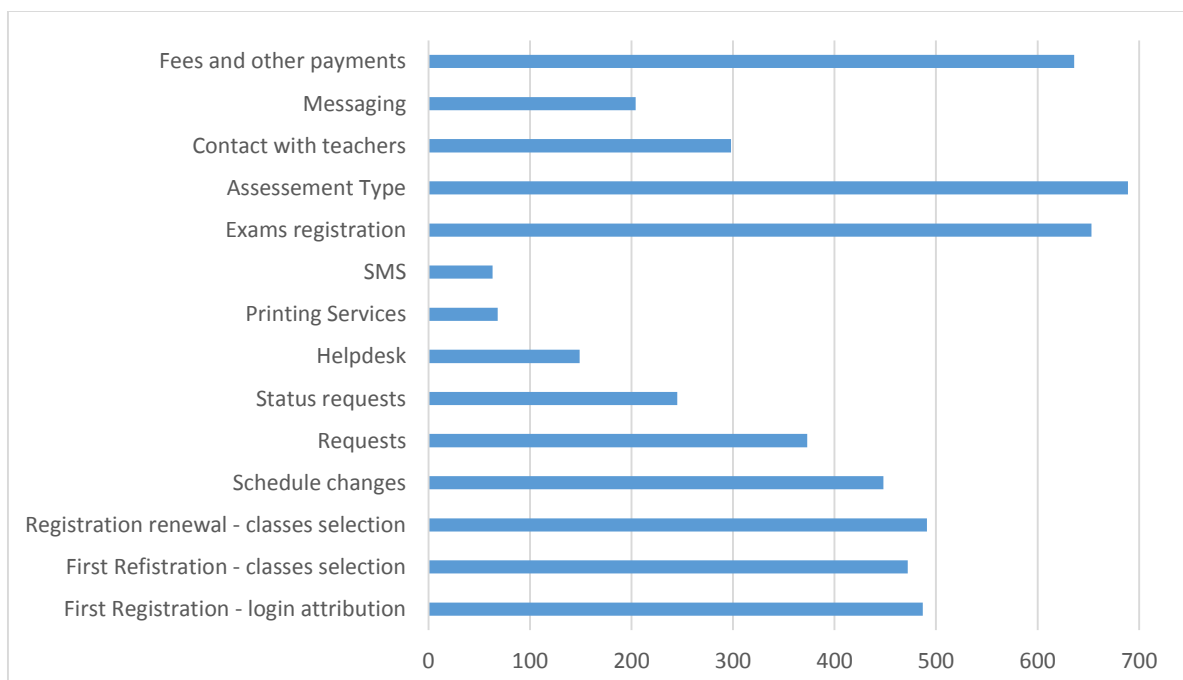
Services	Average (1-6)	
	Physical	Online
Fast service	2,83	3,16
Information Quality	3,38	3,47
Fast problem resolution	2,96	3,05
Workflow	3,10	3,26
Organization	3,21	3,40
Internal Communication	3,13	3,33

#### 4. Utilization type

##### 4.1. Frequency



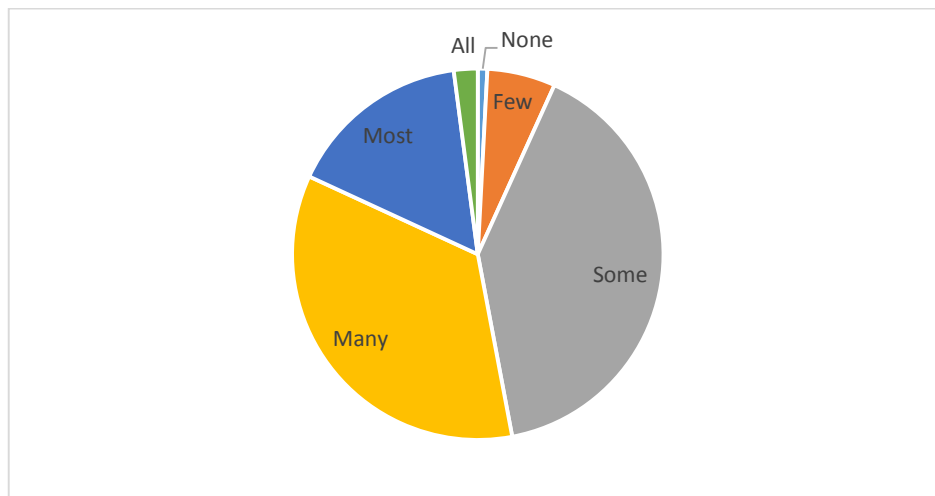
##### 4.2. Services most used



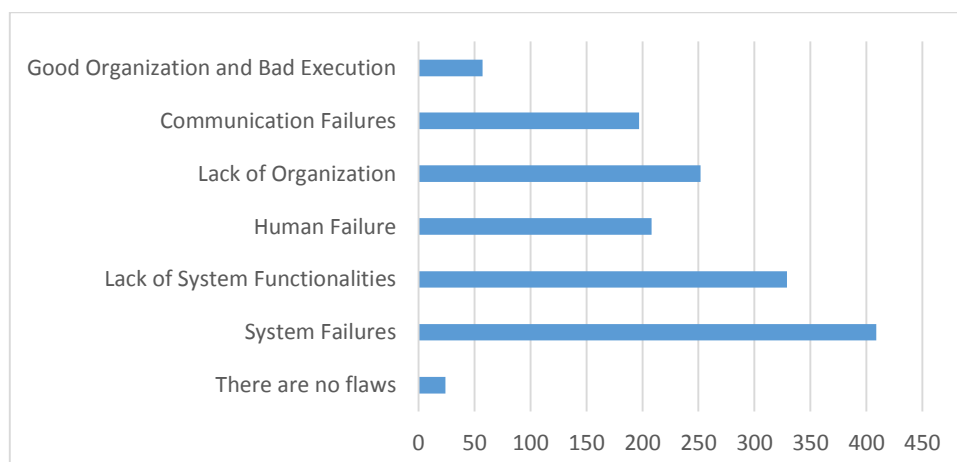
## 5. Functionalities evaluation

Functionality	Avagerage Evalutaion (1 - 6)
<b>Schedule changes</b>	<b>3,17</b>
<b>Helpdesk</b>	<b>3,20</b>
<b>Status requests</b>	<b>3,25</b>
<b>Requests</b>	<b>3,27</b>
SMS	3,37
Printing Services	3,38
Messaging	3,45
Contact with teachers	3,47
First Registration - login attribution	3,82
Registration renewal - classes selection	3,84
First Refistration - classes selection	3,84
Assesement Type	3,98
Exams registration	4,13
Fees and other payments	4,29

## 6. Customer Needs vs Functionalities Correspondence



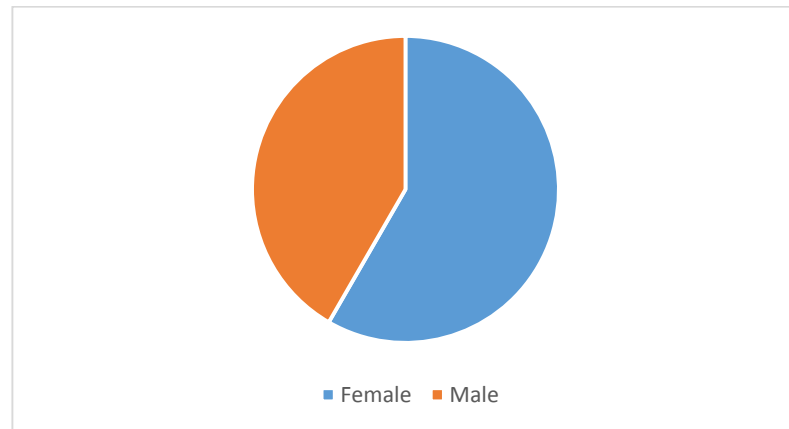
## 7. Flaws Origin Perception



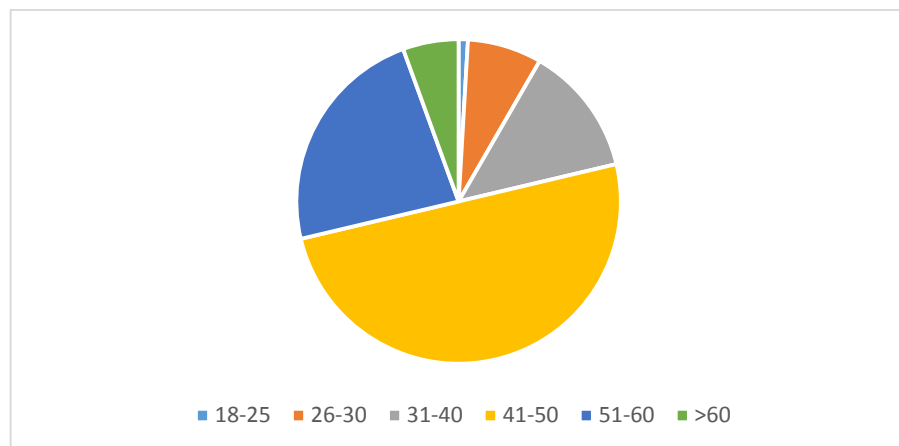
## APPENDIX I: Professors Questionnaire Results

### 1. Sample characterization

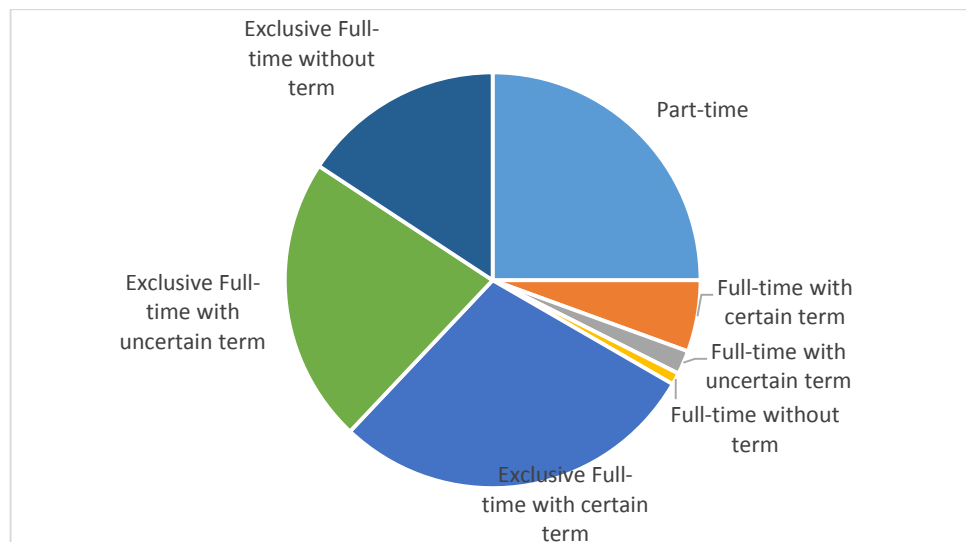
#### 1.1. Gender



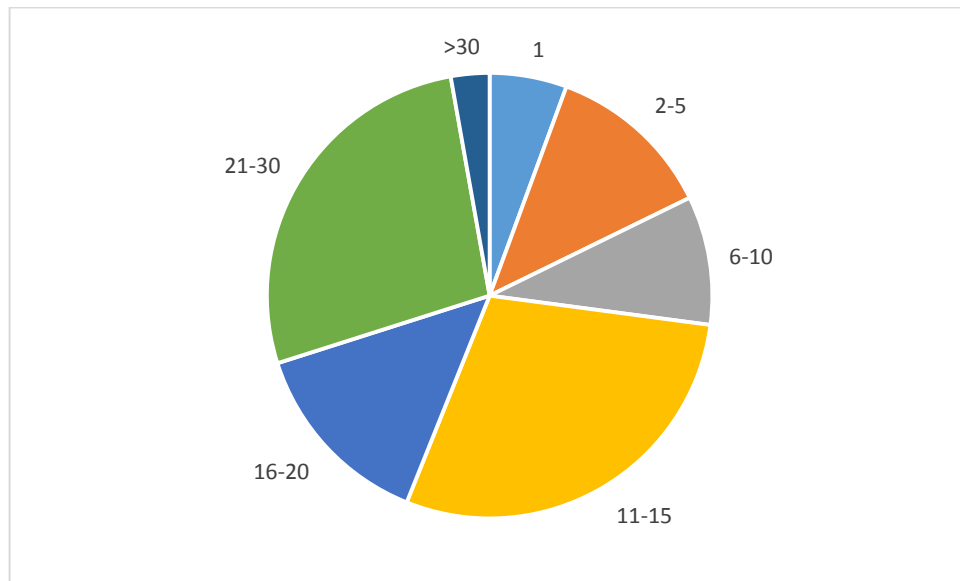
#### 1.2. Age



#### 1.3. Contract Type



#### 1.4. Contract Duration (years)



#### 1.5. Responsibilities

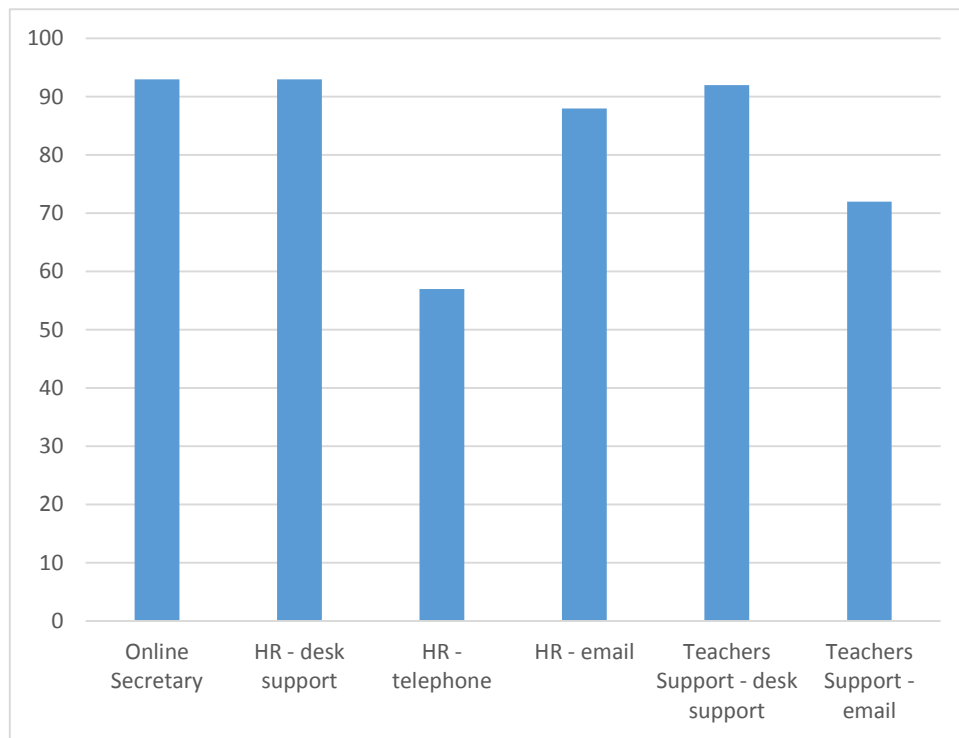
Presidency	1
Administrative Council	2
Consulting Council	4
Pedagogical Council	6
Technical-scientific Council	12
Other sub-council	13
None	72

## 2. Institution Structure Knowledge

	Do you know the Organization Chart?	Do you know the supporting management offices?
Yes	105	105
No	3	3



### 3. Academic Services Interaction



### 4. Experience with services

#### 4.1. Academic Services (physical)



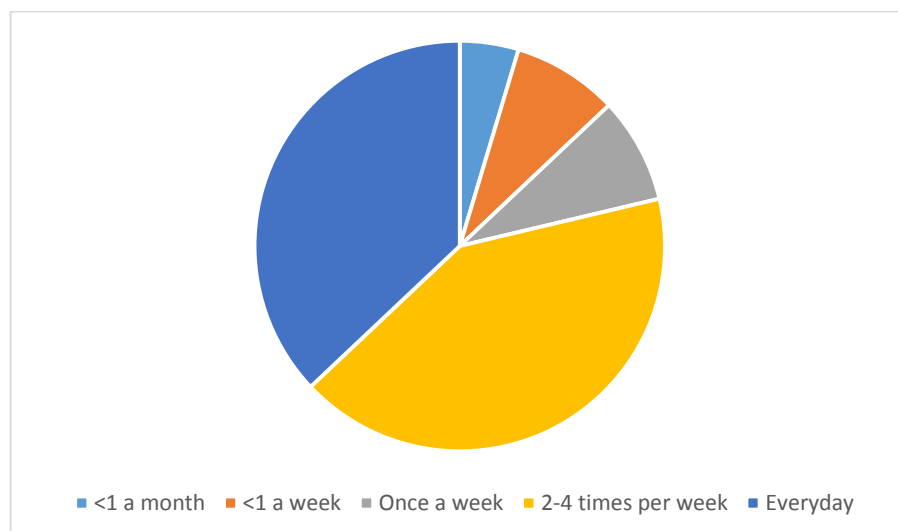
## 4.2. Online Services



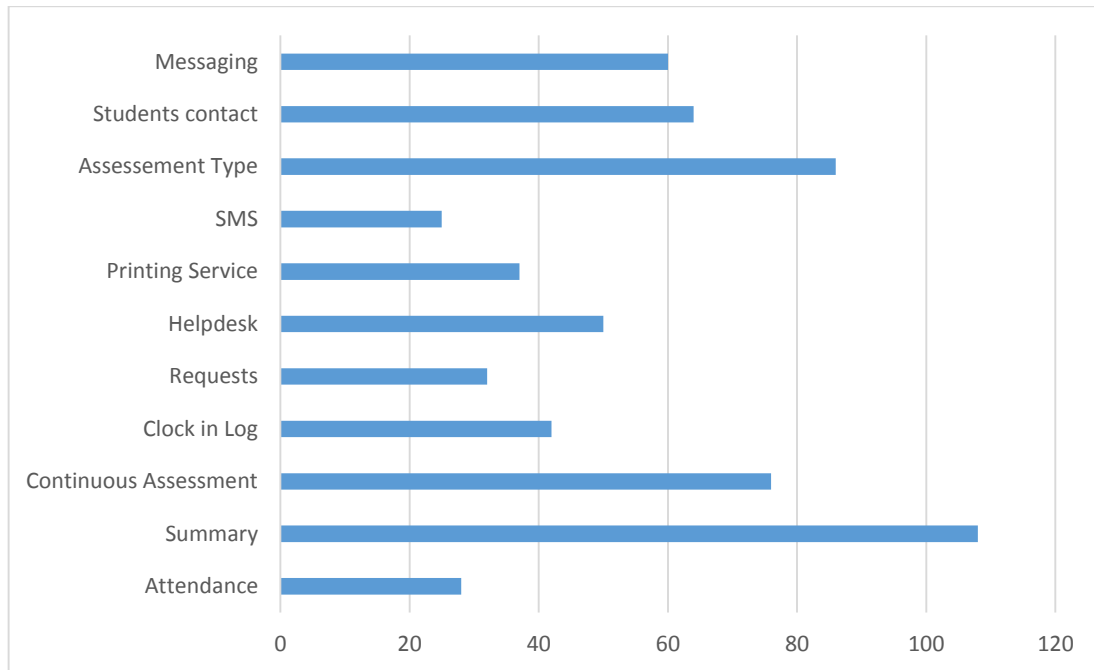
Services	Average (1-6)	
	Physical	Online
Fast service	4,73	4,60
Information Quality	4,80	4,60
Fast problem resolution	4,60	4,32
Workflow	4,44	4,40
Organization	4,48	4,33
Internal Communication	4,37	4,26

## 5. Utilization type

### 5.1. Frequency



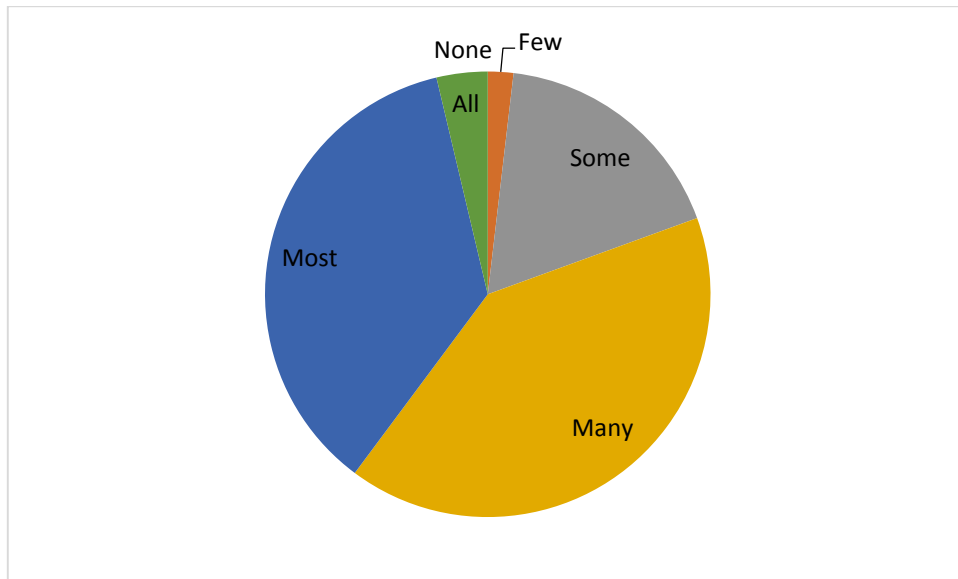
## 5.2. Services most used



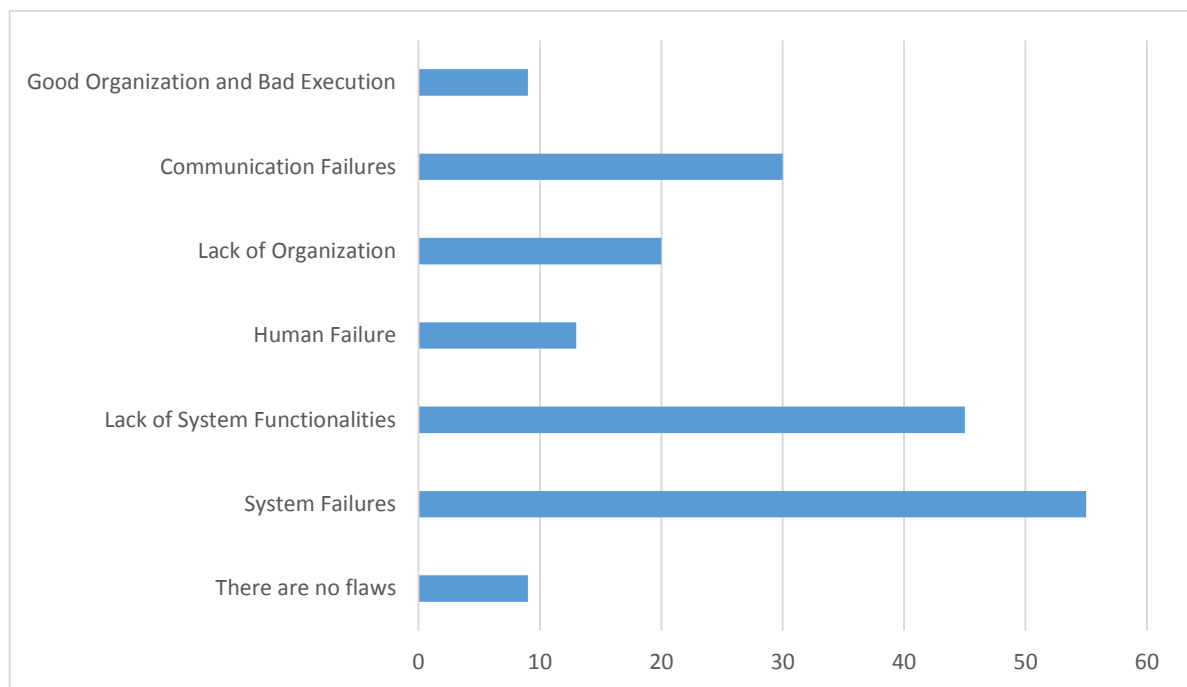
## 6. Functionalities evaluation

Functionalities	Average (1-6)
Attendance	3,83
Messaging	4,08
Students contact	4,19
Clock in Log	4,36
Printing Service	4,38
Requests	4,44
Helpdesk	4,48
SMS	4,48
Continuous Assessment	4,74
Summary	4,78
Assesment Type	4,80

## 7. Customer Needs vs Functionalities Correspondence



## 8. Flaws Origin Perception



## APPENDIX J: Hypothesis testing

Criteria	Mean Rating		Difference between means
	Experience with Physical Services	Experience with Online Services	
Fast service	2,83	3,16	0,33
Information Quality	3,38	3,47	0,09
Fast problem resolution	2,96	3,05	0,09
Workflow	3,10	3,26	0,16
Organization	3,21	3,40	0,20
Internal Communication	3,13	3,33	0,20
Mean (M)			0,18

$$t = \frac{M - \mu}{s_M}$$

t – t-student distribution value

M – sample mean (M=0,18)

μ – hypothesized value (μ=0)

s<sub>M</sub> – estimated standard error of the mean

$$s_M = \frac{s}{\sqrt{N}}$$

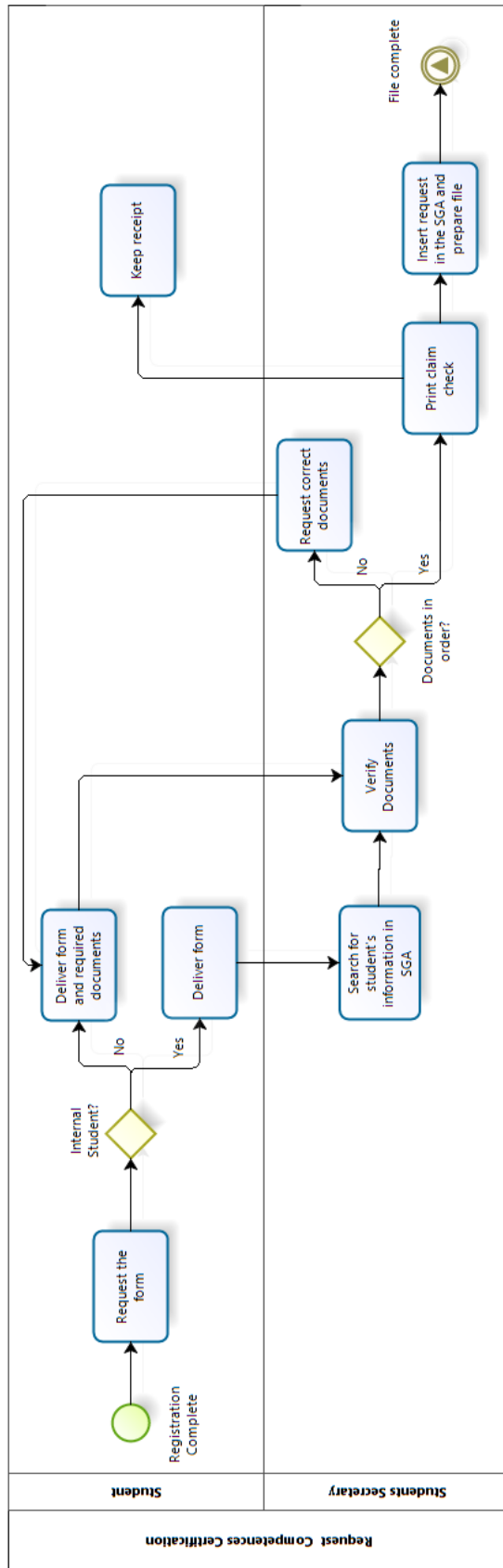
s – standard deviation (s=0,089)

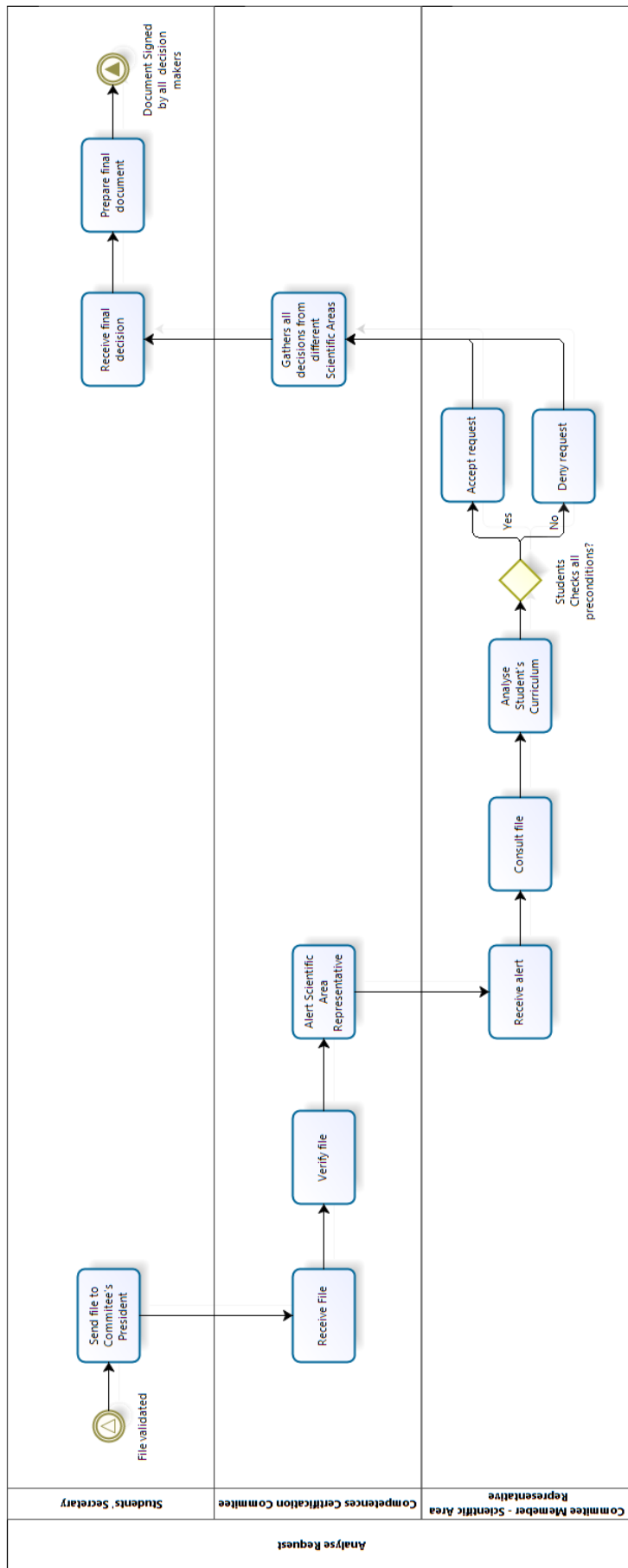
N – sample size (N=6)

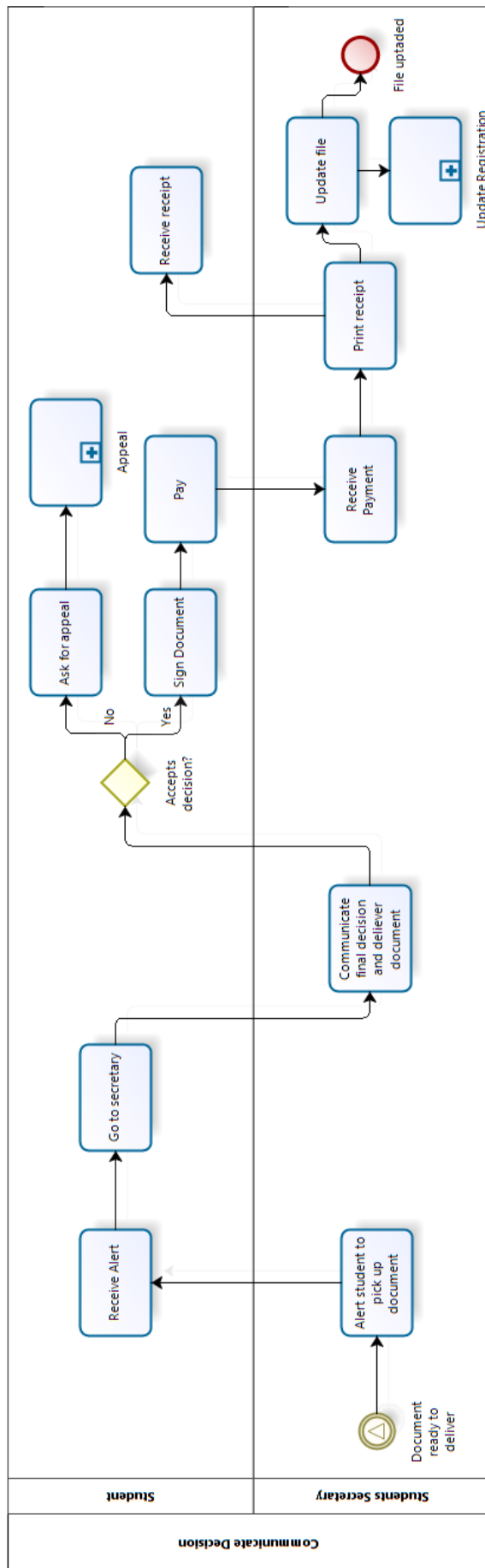
$$s_M = 0,036 \Rightarrow t = 4,95$$

$$p(t \neq 4,95) = 0,00426$$

## APPENDIX K: Process Model As-Is

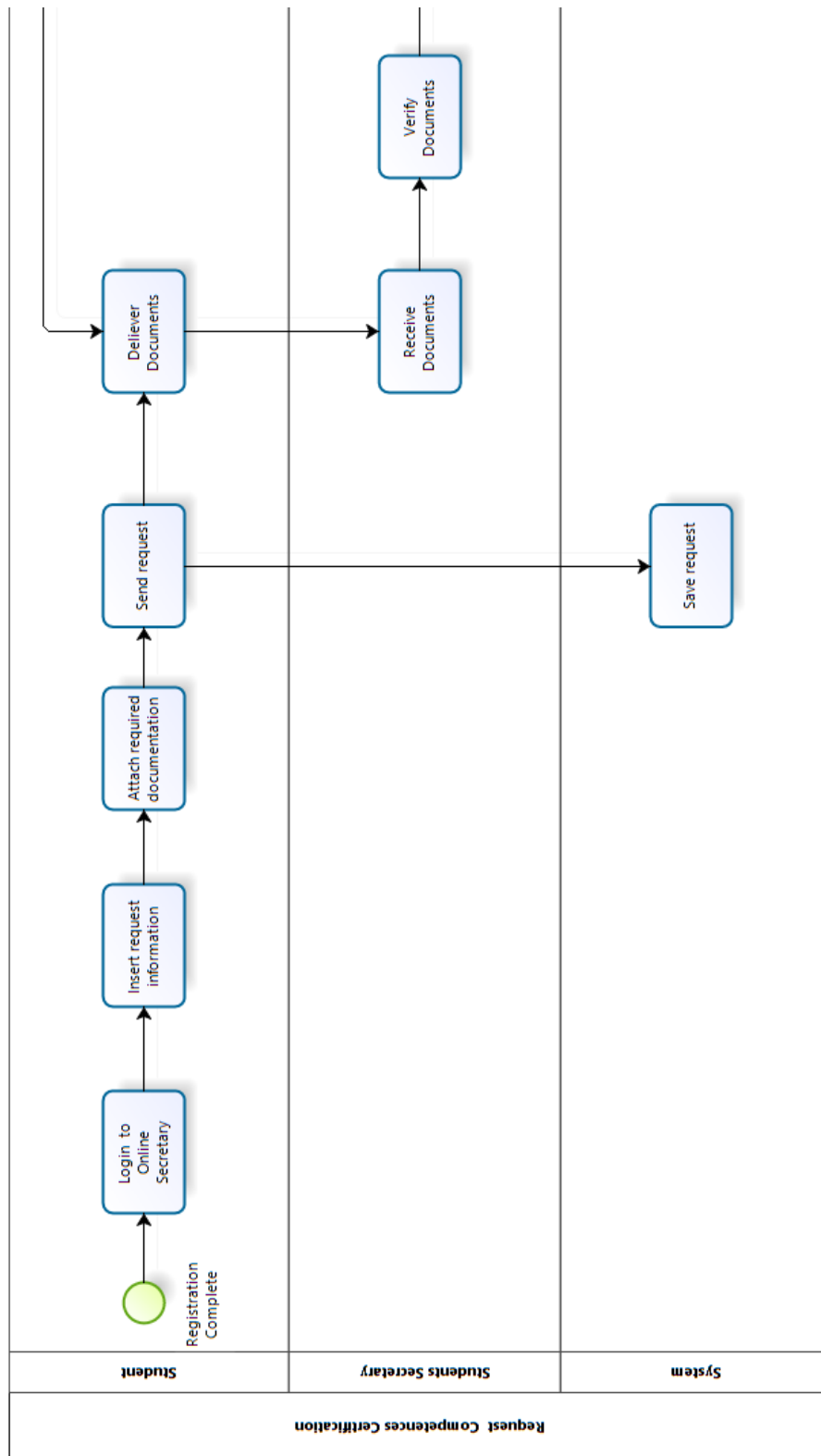




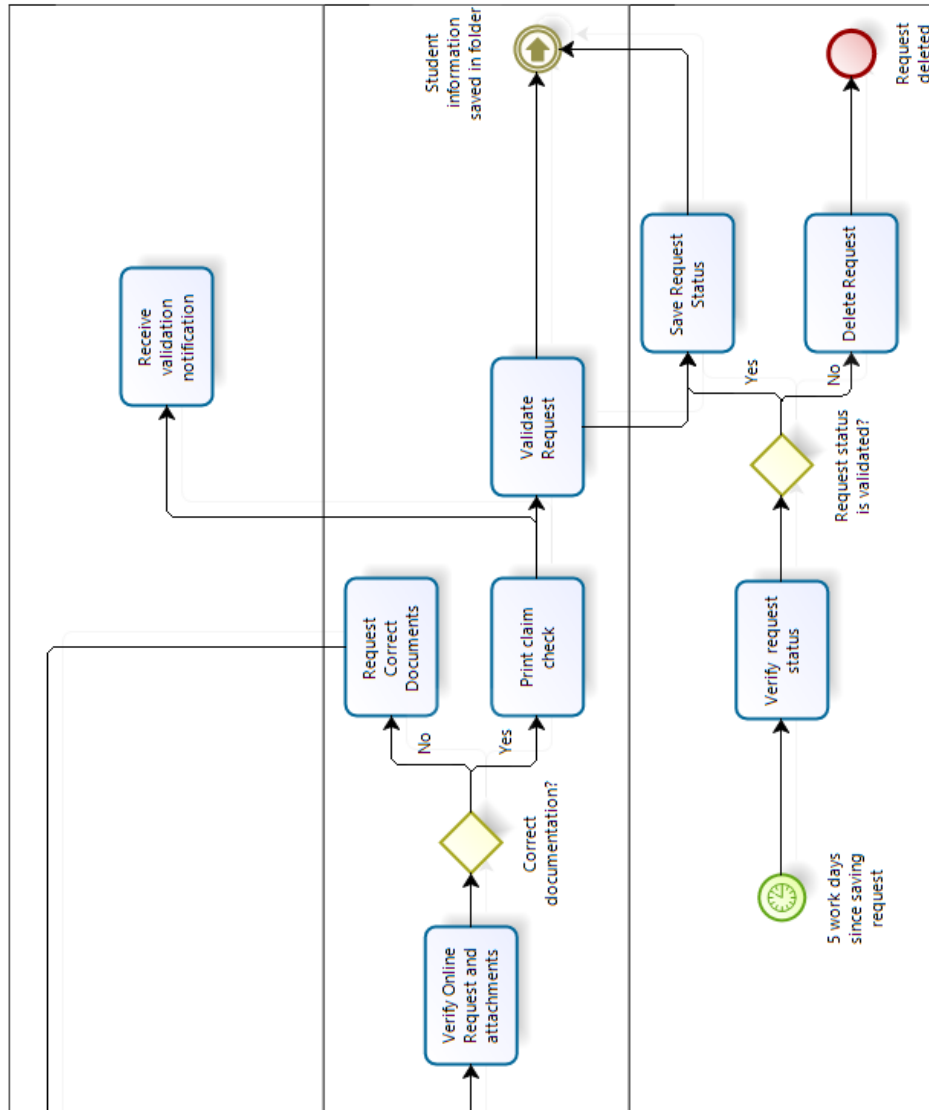


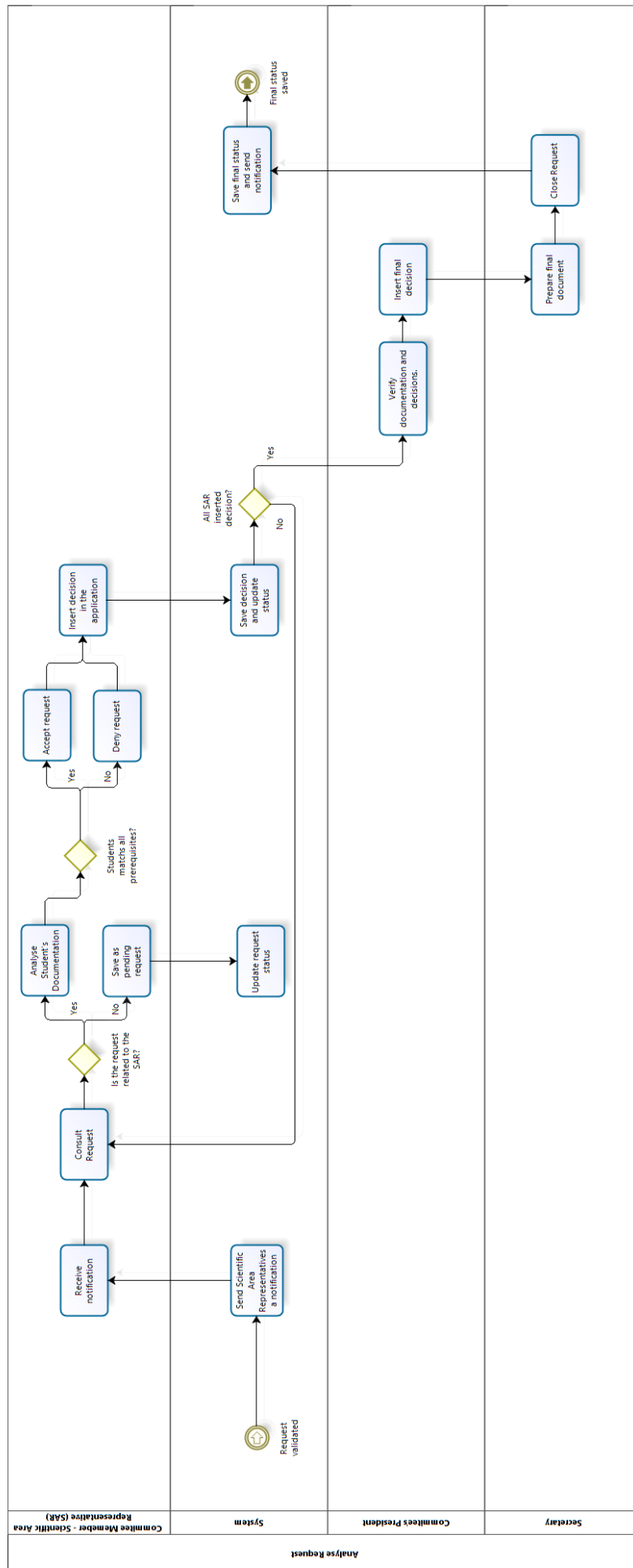


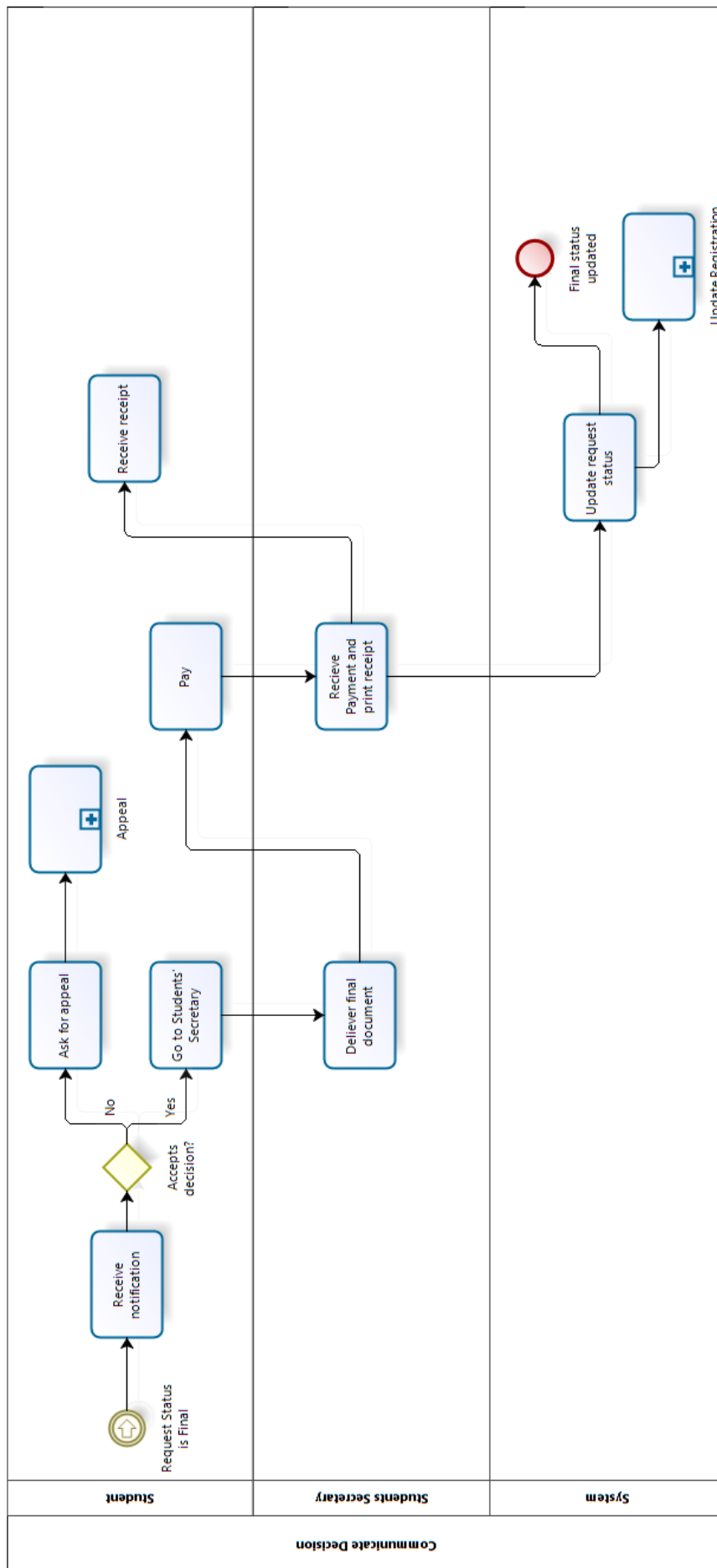
## APPENDIX L: Process Model To Be



p







## APPENDIX M: Service System Architecture

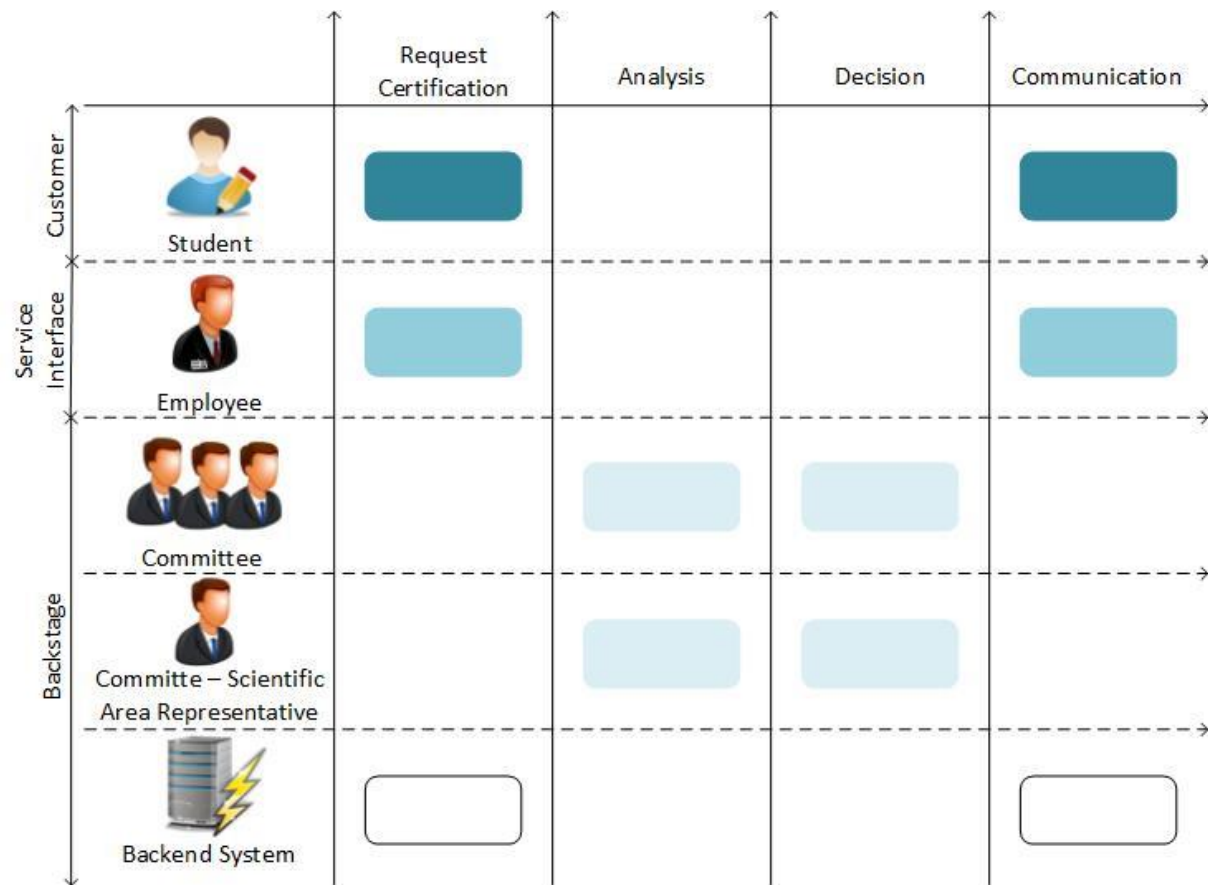


Figure 34. Current Service System Architecture for the New Competences Certification Request.

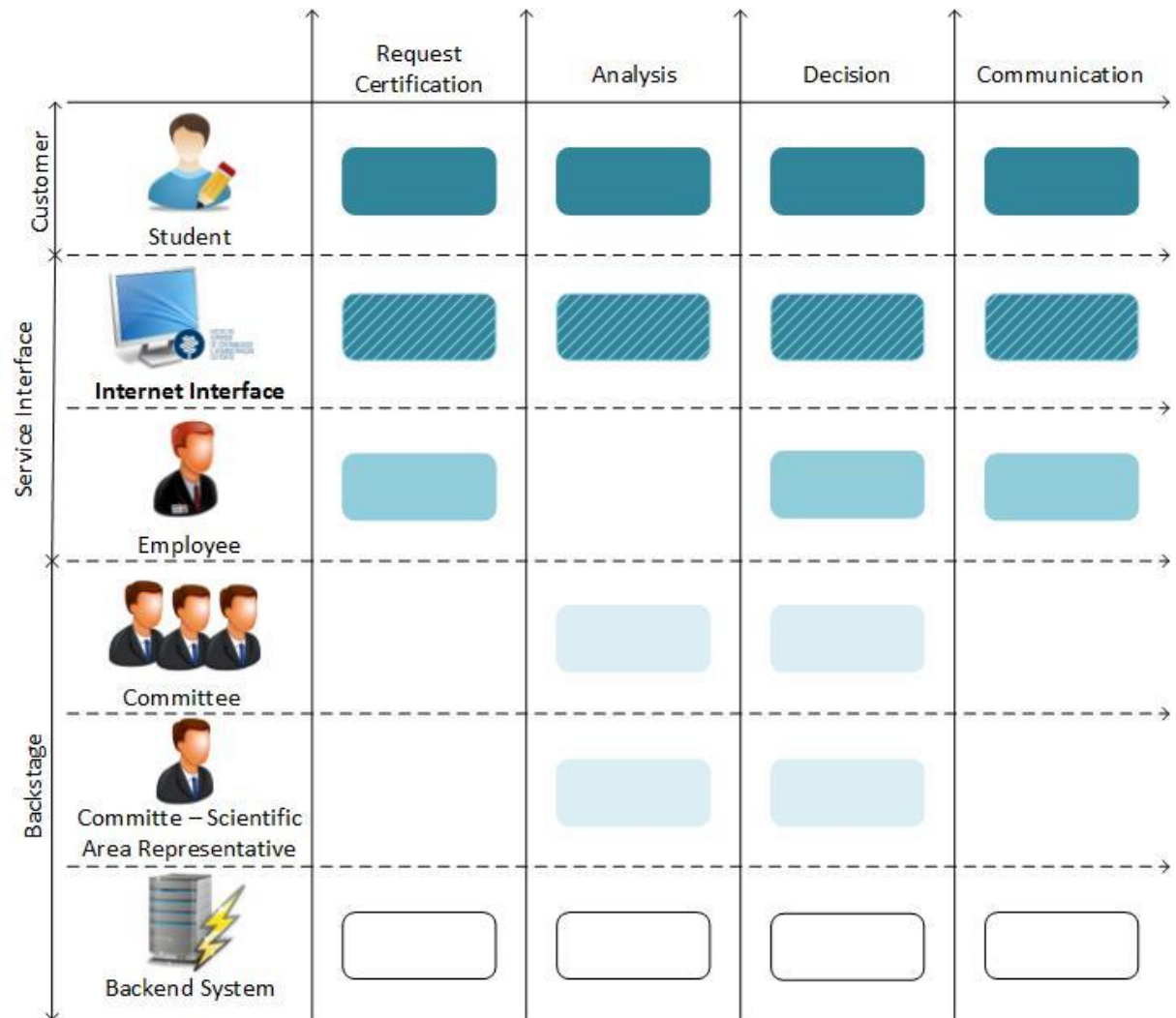


Figure 35. New Service System Architecture for the New Competences Certification Request.

## APPENDIX N: Service System Navigation

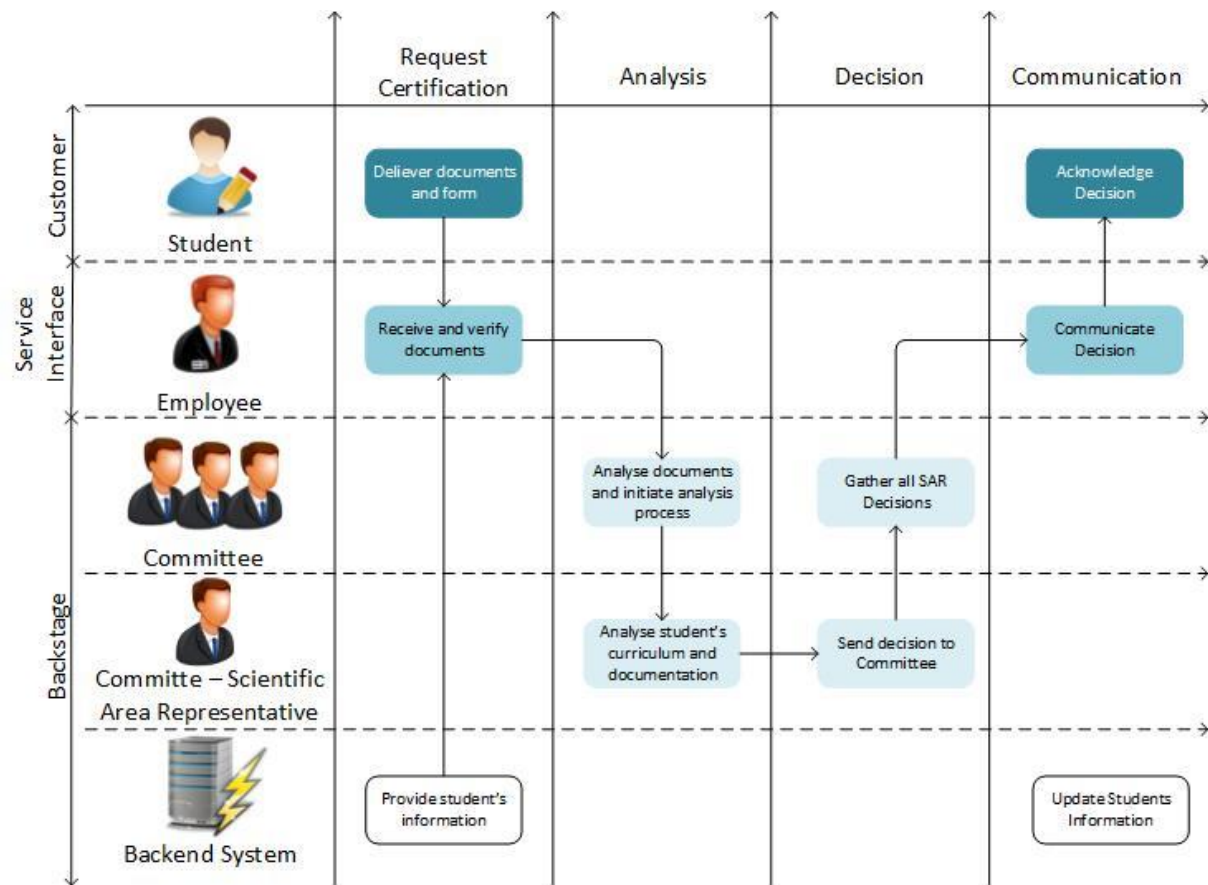


Figure 36. Current Service System Navigation for the New Competences Certification Request.

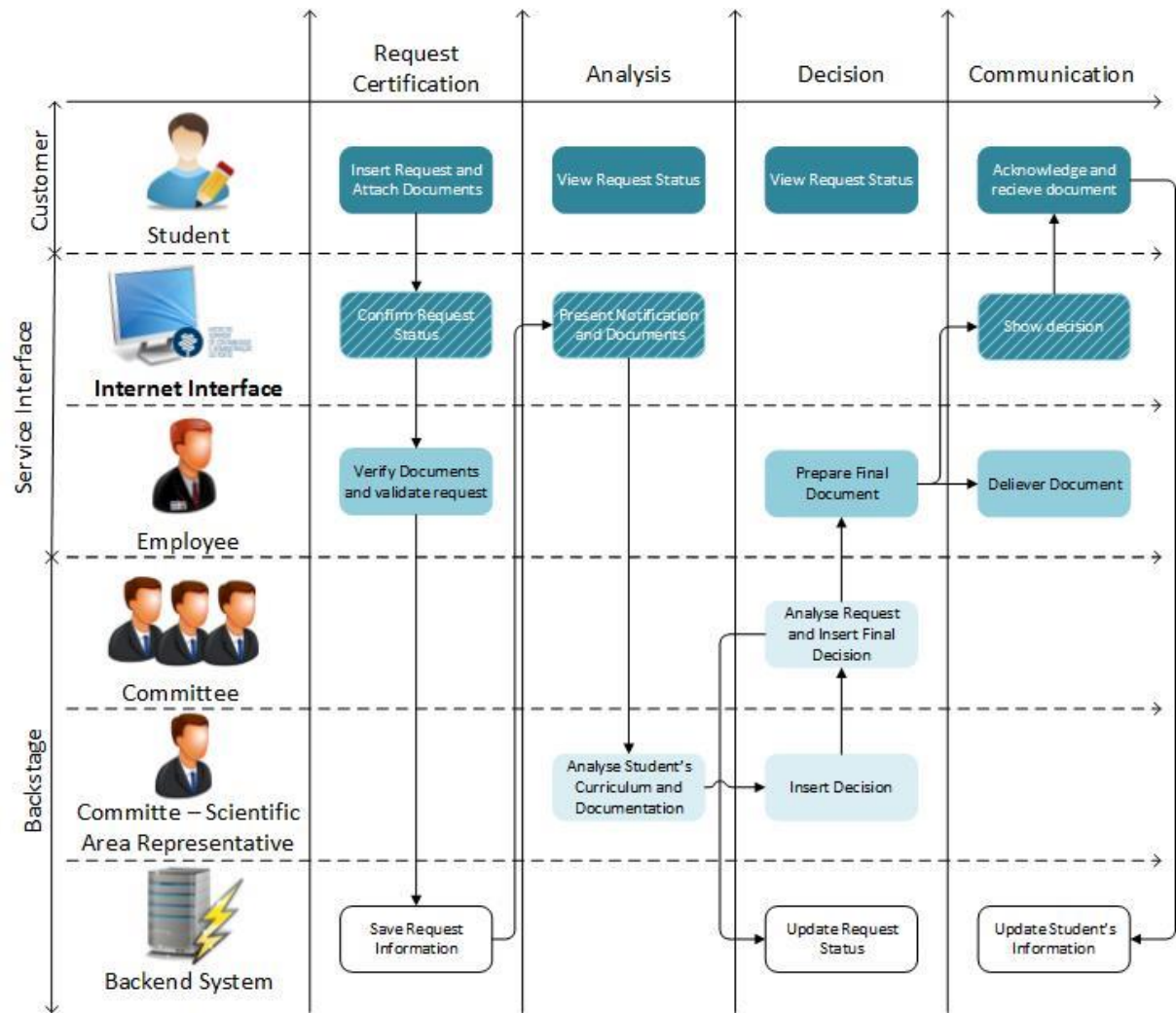
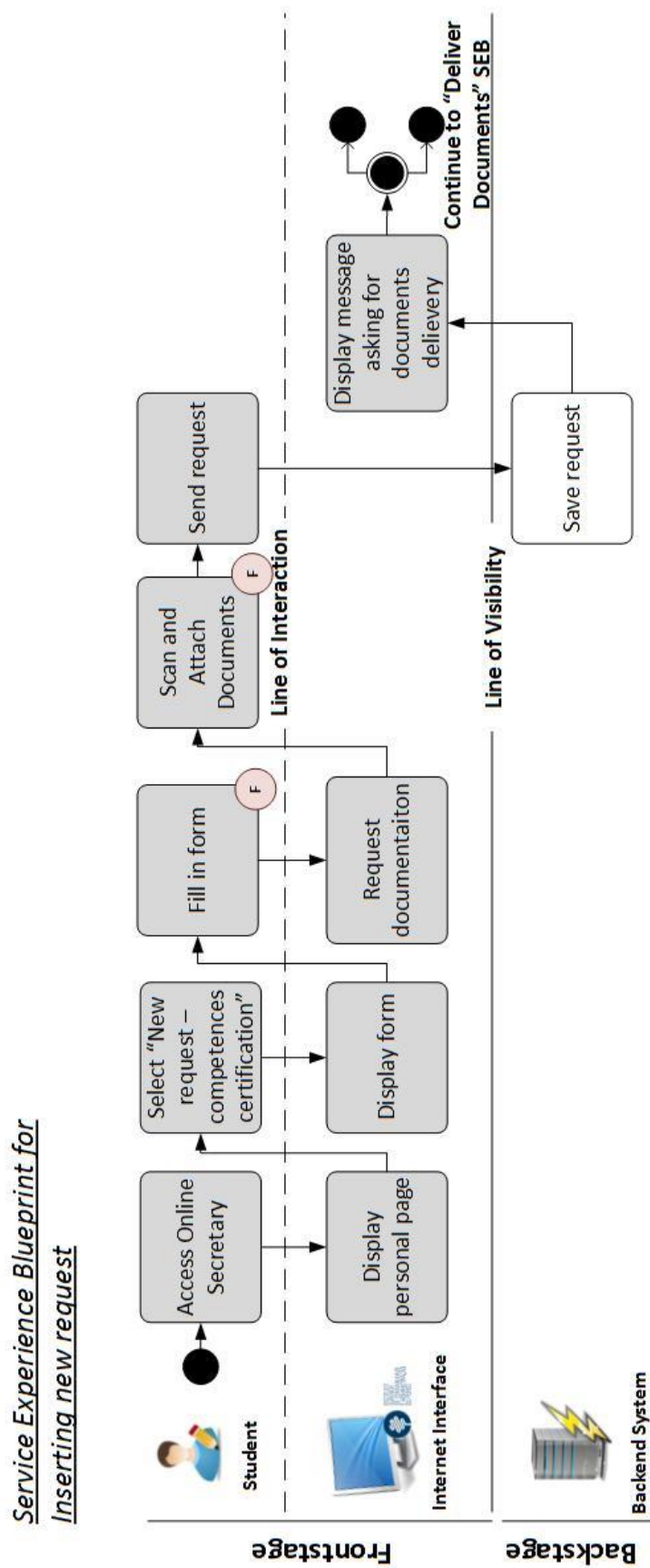
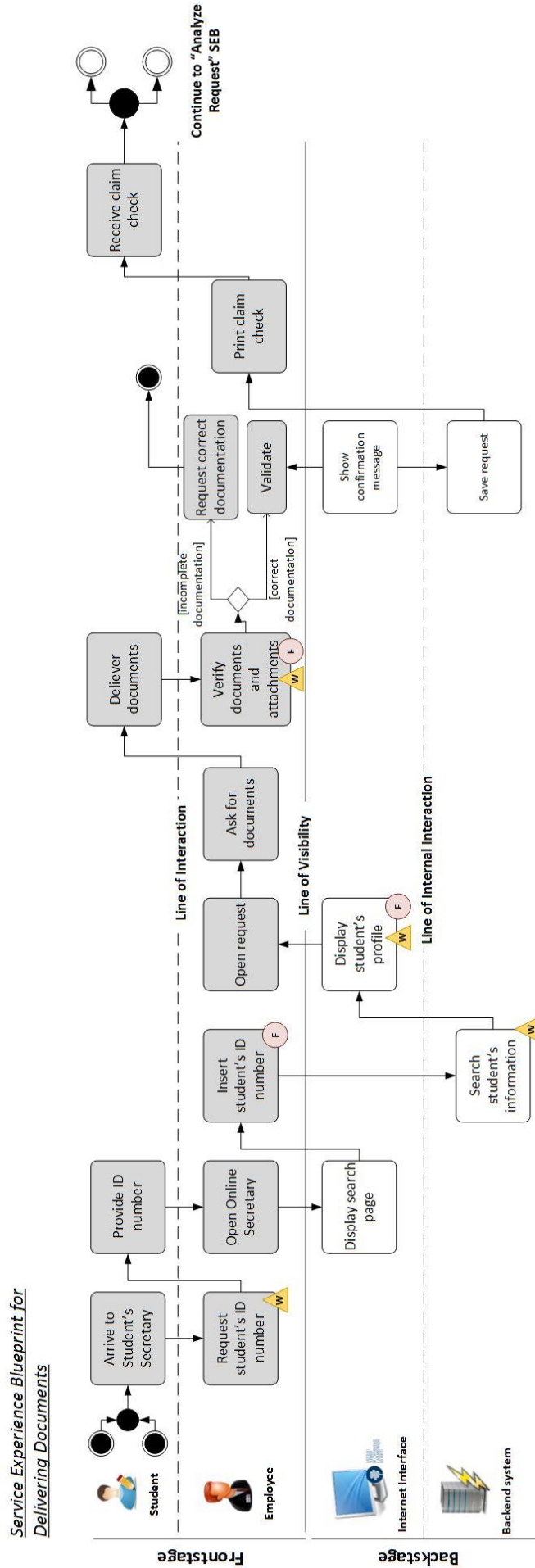


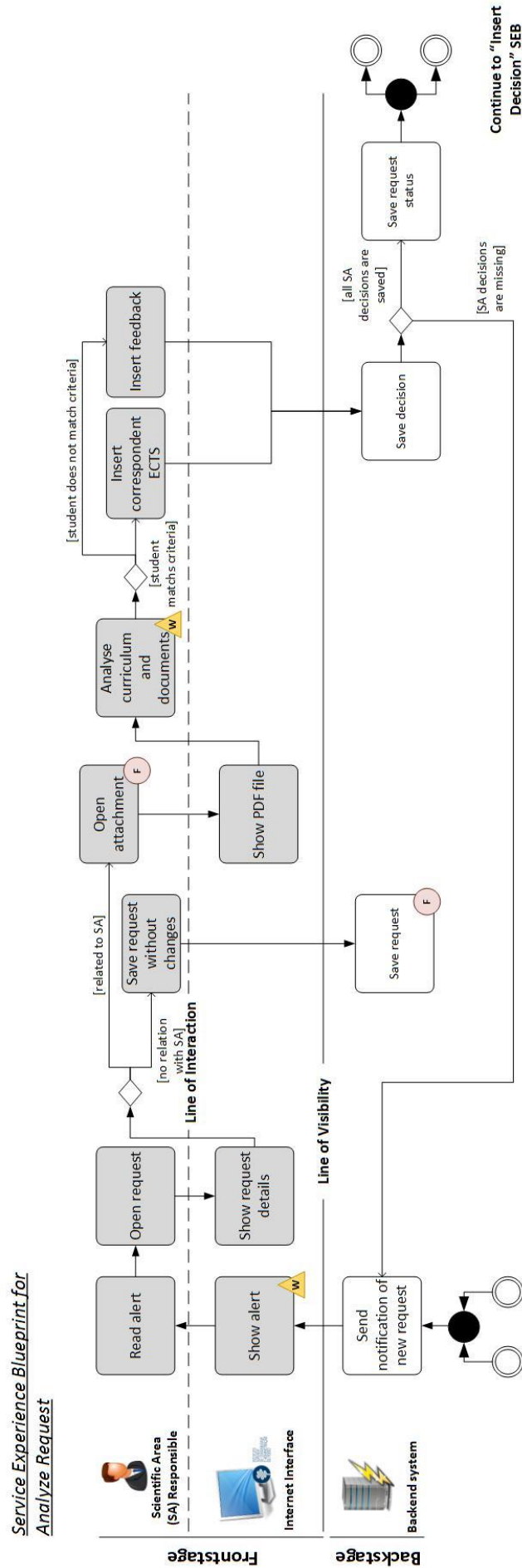
Figure 37. New Service System Navigation for the New Competences Certification Request.



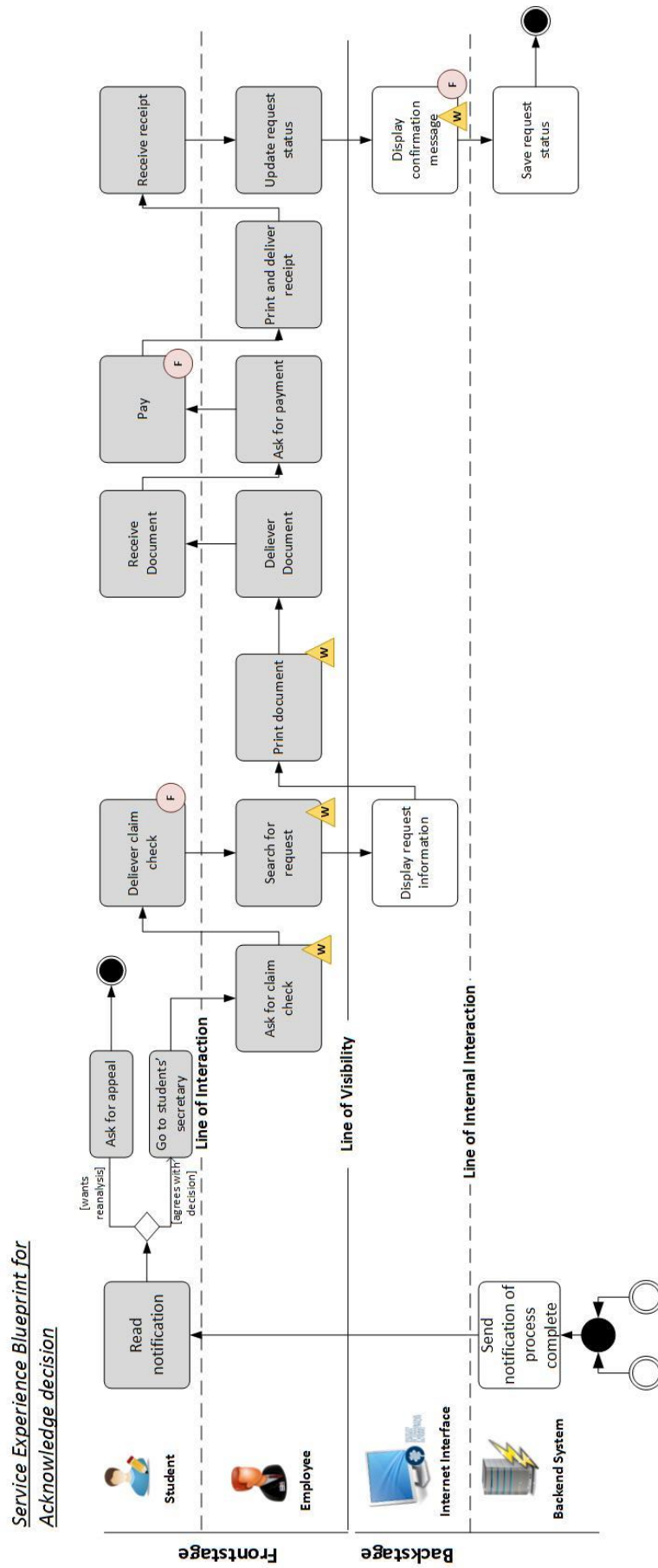
## APPENDIX O: Service Experience Blueprints











## APPENDIX P: Service Experience Blueprints - alternatives

